NUCLEAR SCIENCE ABSTRACTS

ENGINEERING
SEP 23 1958
LIBRARY

September 15, 1958

Volume 12 Number 17
Abstracts 11205-12105

UNITED STATES ATOMIC ENERGY COMMISSION
Technical Information Service Extension, Oak Ridge, Tennessee

USAEC DEPOSITORY LIBRARIES

The libraries listed below maintain collections of unclassified U. S. Atomic Energy Commission reports for reference use by the general public. These depository collections are conveniently organized, and staff members of the libraries will assist requesters in the use of the collections. All the libraries have facilities for making photocopies of reports that are not more conveniently available in printed form from the Office of Technical Services. Canadian reports in the AECL series and currently issued British reports in the AERE and IG series are also available at the Libraries listed below. More complete sets of older British reports are available at those libraries identified with an asterisk (*).

ALABAMA
Auburn, Alabama Polytechnic Institute Library
Birmingham, Birmingham Public Library

ARIZONA
Tucson, University of Arizona Library

ARKANSAS
Fayetteville, University of Arkansas Library

CALIFORNIA
*Berkeley, University of California General Library
Los Angeles, University of California Library
Menlo Park, Stanford Research Institute
San Diego, San Diego Public Library

COLORADO
Denver, Denver Public Library

CONNECTICUT
New Haven, Yale University Library

DELAWARE
Newark, University of Delaware Library

DISTRICT OF COLUMBIA
Washington, Library of Congress

FLORIDA
Coral Gables, University of Miami Library
Gainesville, University of Florida Engineering Sciences Library

GEORGIA
Atlanta, Georgia Institute of Technology Library

ILLINOIS
*Chicago, John Crerar Library
Chicago, University of Chicago Library
Evanston, Northwestern University Library
Urbana, University of Illinois Library

INDIANA
Indianapolis, Indianapolis Public Library
Lafayette, Purdue University Library

IOWA
Ames, Iowa State College Library

KANSAS
Manhattan, Kansas State College Library

KENTUCKY
Lexington, University of Kentucky Library
Louisville, University of Louisville Library

LOUISIANA
Baton Rouge, Louisiana State University Library
New Orleans, Tulane University Library

MARYLAND
Baltimore, Johns Hopkins University Library
College Park, University of Maryland Engineering and Physical Sciences Library

MASSACHUSETTS
Cambridge, Harvard University Library
Cambridge, Massachusetts Institute of Technology Library

MICHIGAN
Ann Arbor, University of Michigan Library
Detroit, Detroit Public Library

MINNESOTA
Minneapolis, University of Minnesota Library

MISSOURI
Kansas City, Linda Hall Library
Rolla, The University of Missouri School of Mines and Metallurgy Library
St. Louis, Washington University Library

NEW JERSEY
Princeton, Princeton University Library

NEW MEXICO
Albuquerque, University of New Mexico Library

NEW YORK
Buffalo, Lockwood Memorial Library
Ithaca, Cornell University Library
New York, Atomic Industrial Forum
New York, Columbia University Library
*New York, New York Public Library
Rochester, University of Rochester Library
Schenectady, Union College Library
Troy, Rensselaer Polytechnic Institute Library

NORTH CAROLINA
Charlotte, Charlotte and Mecklenburg County Public Library
*Durham, Duke University Library
Raleigh, North Carolina State College Library

OHIO
Cincinnati, University of Cincinnati Library
Cleveland, Cleveland Public Library
Columbus, Ohio State University Library
Toledo, University of Toledo Library
Youngstown, Youngstown University Library

OKLAHOMA
Stillwater, Oklahoma State University Library

OREGON
Corvallis, Oregon State College Library
Portland, Portland Public Library

PENNSYLVANIA
Philadelphia, University of Pennsylvania Library
Pittsburgh, Carnegie Library of Pittsburgh
University Park, Pennsylvania State University, Pattee Library

PUERTO RICO
Rio Piedras, University of Puerto Rico, Main Library

RHODE ISLAND
Providence, Brown University Library

SOUTH CAROLINA
Columbia, University of South Carolina, McKissick Memorial Library

TENNESSEE
Knoxville, University of Tennessee Library
Memphis, Memphis Public Library
Nashville, Joint University Libraries

TEXAS
Austin, University of Texas Library
College Station, Agricultural and Mechanical College of Texas Library
Dallas, Southern Methodist University Library
Houston, The Rice Institute Library
San Antonio, San Antonio Public Library

UTAH
Salt Lake City, University of Utah Library

VIRGINIA
Blacksburg, Virginia Polytechnic Institute Library
Charlottesville, University of Virginia, Alderman Library

WASHINGTON
Pullman, State College of Washington Library
Seattle, University of Washington Library

WEST VIRGINIA
Morgantown, West Virginia University Library

WISCONSIN
Madison, University of Wisconsin Library
Milwaukee, Milwaukee Public Library

WYOMING
Laramie, University of Wyoming Library

SCOPE

Nuclear
neers w
as prom
covers r
Atomic
pears in
universi
scientifi

INDEXES

Each iss
Semiann
clude su
listing th
number,
No. 24B,

AVAILAB

NSA is i
cording t
or by su
the Super
ington 25,

Change
address.
search in
tion. The
exchangin

Inquirie
of addres
Technical
P. O Box

NEW NUC

NSA has i
Data in wh
the excep
The annua
lists of N
National R

Other c
moments,
annual sub
began issu
also incor
which has
Nuclear S
Nuclear D
Data consi
sibly additi
Vol. 12.

The Nucl
in binders
prices are
used in the

NUCLEAR SCIENCE ABSTRACTS

A Publication of the United States Atomic Energy Commission Technical Information Service.

SCOPE

Nuclear Science Abstracts (NSA) is intended to serve scientists and engineers working in the field of atomic energy by abstracting as completely and as promptly as possible the literature of nuclear science and engineering. It covers not only unclassified and declassified research reports of the U. S. Atomic Energy Commission and its contractors, but also material that appears in research reports of other U. S. and foreign government agencies, universities, and industrial research organizations and in the technical and scientific journals.

INDEXES

Each issue of *NSA* is indexed by personal author and by report number. Semiannual and annual index issues are prepared for each volume and include subject, corporate and personal author, and report number indexes, listing the availability of all USAEC reports abstracted. A cumulated report number, author, and subject index to Vols. 1 through 4 was issued as Vol. 4, No. 24B, Dec. 30, 1950.

AVAILABILITY

NSA is issued twice a month and is available in single copies (priced according to the number of pages they contain, plus postage on foreign orders) or by subscription ($12.00 a year domestic, $15.00 a year foreign) from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Change of address notices for subscriptions should be sent to the above address. *NSA* is also available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. The USAEC invites inquiries from such organizations interested in exchanging publications.

Inquiries about exchanges and other official distribution, as well as change of address notices for official and exchange recipients, should be sent to the Technical Information Service Extension, U. S. Atomic Energy Commission, P. O Box 62, Oak Ridge, Tennessee.

NEW NUCLEAR DATA

NSA has in the past carried in issues 6B, 12B, and 18B lists of New Nuclear Data in which experimental results were displayed in tabular form and, with the exception of Vol. 11 (1957), in issue 24B carried an annual cumulation. The annual cumulation for 1957 was issued as a separate publication. These lists of New Nuclear Data were compiled by the Nuclear Data Group of the National Research Council, Washington 25, D. C.

Other current data on radioactivity, nuclear energy levels, reactions, moments, etc., were also supplied by that group on 3 × 5 inch cards on an annual subscription basis. Beginning in January 1958 the Nuclear Data Group began issuing 8½ × 11 inch Nuclear Data Sheets which replace the cards and also incorporate the table "Radioactivity, Levels, Abundances, Moments," which has comprised the greater portion of the New Nuclear Data issues of *Nuclear Science Abstracts*. For this reason the quarterly issues of New Nuclear Data have been discontinued. The 1958 cumulation of New Nuclear Data consisting of tables previously listed in the quarterly issues, and possibly additional tables, will appear as issue 24B of *Nuclear Science Abstracts* Vol. 12.

The Nuclear Data Sheets are available in a light-weight stock for insertion in binders and a heavy-weight stock for drawer filing. Annual subscription prices are $15 for the light and $18 for the heavy stock. Parcel post will be used in the U.S.A., printed matter mail elsewhere. Order from the Publications Office, National Academy of Sciences-National Research Council, 2101 Constitution Avenue, Washington 25, D. C.

AVAILABILITY OF REPORTS ABSTRACTED

USAEC reports (as identified in the Numerical Index of Reports) are available free of charge to U. S. Government agencies and their contractors from the Technical Information Service Extension, Oak Ridge, Tennessee. Other requesters should obtain reports as described below.

AEC Reports The Office of Technical Services, Department of Commerce, Washington 25, D. C., is the sales agency for AEC unclassified reports, although a small number of other AEC unclassified reports are available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. The sales availability of each report is given in the abstract. The symbol "OTS" indicates availability from the Office of Technical Services, and "ph" and "mf" indicate photostat and microfilm copy. The form is not specified if the report is available in printed form. Sales availability is also given in the semiannual and annual Numerical Index of Reports.

Price lists of the Office of Technical Services and of the Superintendent of Documents may be obtained upon request from these sales agencies. Reports should be ordered by report number and title. A check or money order made payable to the Treasurer of the United States should accompany each order. Foreign purchasers of reports, other than those in Canada and Mexico, should include an additional amount for postage, according to the scale that four pages approximate one ounce. It is the purchaser's responsibility to compute the necessary postage since rates vary for different countries.

The USAEC has made contractual arrangements for the sale of microcopy of AEC reports from the Microcard Foundation, P. O. Box 2145, Madison 5, Wisconsin, and the Readex Microprint Corporation, 115 University Place, New York 3, N. Y.

Many reports abstracted in *NSA* may be published subsequently in scientific and technical journals and books. The pertinent publication information is listed in the semiannual and annual cumulations of the Numerical Index of Reports and in the *Cumulated Numerical List of Available Unclassified U. S. Atomic Energy Commission Reports* (TID-4000).

USAEC reports also may be consulted at the AEC depository libraries listed on the inside front cover. Collections of AEC reports outside the United States have been established and are being maintained at those addresses listed on the inside back cover.

Non - AEC Reports Reports prepared by organizations not under contract to the USAEC (as identified in the Numerical Index of Reports) should be requested from the issuing agency indicated in the abstract of the report. Requests for reports abstracted under NP numbers should give title and author since these numbers are assigned by the USAEC and may not be known by the originating agency. British and Canadian reports are available for examination at the AEC depository libraries. British reports can also be purchased from the British Information Service (identified in the abstract as BIS), 30 Rockefeller Plaza, New York, N. Y. Canadian reports (AECL series) can be purchased from the Scientific Document Distribution Office, Atomic Energy of Canada Limited, Chalk River, Ontario, Canada.

Translations Copies of translations prepared by the USAEC and its contractors are available from the Special Libraries Association Translation Center, John Crerar Library, 86 E. Randolph Street, Chicago 1, Illinois.

U. S. Patents Copies of U. S. patents are available from the U. S. Patent Office, Department of Commerce, Washington 25, D. C., for $0.25 per copy.

The printing of this publication has been approved by the Director of the Bureau of the Budget, July 30, 1957.

CONTENTS

Volume 12, Number 17, September 15, 1958

Category	Abstract	Page
GENERAL	11205	1325
Atomic Bombs and Warfare	11205	1325
Atomic Power	11206	1325
Research Programs	11218	1326
BIOLOGY AND MEDICINE	11220	1326
Radiation Effects	11224	1327
Radiation Hazards and Protection	11257	1331
Radiation Sickness	11275	1333
Radiography	11276	1333
Radiotherapy	11278	1333
Toxicology Studies	11282	1334
Tracer Applications	11284	1334
CHEMISTRY	11291	1335
Aerosols	11303	1337
Analytical Procedures	11305	1337
Atomic Weights and Periodic Systems	11329	1340
Crystallography and Crystal Structure	11330	1340
Deuterium and Deuterium Compounds	11332	1340
Fluorine and Fluorine Compounds	11337	1341
Graphite	11338	1341
Laboratories and Equipment	11340	1342
Molecular Structure	11345	1342
Radiation Chemistry	11346	1342
Radiation Effects	11347	1342
Rare Earths and Rare-earth Compounds	11352	1343
Separation Procedures	11355	1344
Sorption Phenomena	11379	1347
Tracer Applications	11381	1347
Transuranic Elements and Compounds	11382	1347
Uranium and Uranium Compounds	11384	1347
Waste Disposal	11393	1348
ENGINEERING	11394	1348
Heat Transfer and Fluid Flow	11399	1349
Materials Testing	11404	1349
Pumps	11411	1350
Tracer Applications	11415	1351
Vacuum Systems	11417	1351
Waste Disposal	11418	1351
MINERALOGY, METALLURGY, AND CERAMICS	11422	1352
Ceramics and Refractories	11422	1352
Corrosion	11426	1353
Geology and Mineralogy	11432	1353
MINERALOGY, METALLURGY, AND CERAMICS		
Metals and Metallurgy	11441	1355
Tracer Applications	11477	1359
PHYSICS	11479	1360
Aerosols	11509	1364
Cosmic Radiation	11512	1364
Crystallography and Crystal Structure	11525	1366
Electrical Discharge	11536	1367
Electrons	11555	1369
Gases	11562	1370
Instruments	11563	1370
Isotopes	11572	1371
Isotope Separation	11574	1371
Mass Spectrography	11576	1372
Mathematics	11577	1372
Measuring Instruments and Techniques	11594	1374
Mesons	11636	1378
Meteorology	11669	1381
Molecular Properties	11671	1382
Neutrons	11674	1384
Nuclear Physics	11754	1392
Nuclear Properties	11775	1395
Nuclear Reactors	11815	1399
Nuclear Transformation	11951	1418
Particle Accelerators	11968	1420
Radiation Absorption and Scattering	11977	1421
Radiation Effects	12009	1425
Radioactivity	12024	1427
Rare Earths and Rare-earth Compounds	12037	1428
Shielding	12040	1429
Spectroscopy	12043	1429
Theoretical Physics	12059	1431
Tritium and Tritium Compounds	12085	1433
Uranium and Uranium Compounds	12087	1434
PATENTS	12094	1434
Chemistry	12094	1434
Engineering	12099	1435
Mineralogy, Metallurgy, and Ceramics	12101	1435
Physics	12105	1435
PERSONAL AUTHOR INDEX		INDEX-1
NUMERICAL INDEX OF REPORTS		INDEX-8

ERRATA

NSA Vol. 8, No. 15, p. 538. In line 43 of abstract 4495, $As^{75}(n,5n)$ ... should be $As^{75}(n,5n)$ ....

NSA Vol. 9, No. 8, p. 355. In line 12 of abstract 2735, The entropy of potassium at 25°K ... should be The entropy of potassium at 25°C ....

NSA Vol. 10, No. 17 Suppl., p. 871. In abstract 7270, WAPD-RM-7 should be WAPD-RM-7(Del.).

NSA Vol. 10, No. 21, p. 1192. In 2nd line of abstract 10163, ... classified reports on ... should be ... unclassified reports on ....

NSA Vol. 11, No. 11, p. 626. In abstract 5840, In descriptive cataloging, pagination 157 p. should be 241p.

NSA Vol. 11, No. 22, p. 1432. In abstract 12897, Mine Safety Appliances Co., Callery, Penna. should be MSA Research Corp., Callery, Penna.

NSA Vol. 11, No. 23 Suppl., p. 1528. In abstract 13737, declassification date in descriptive cataloging, March 28, 1952 should be Mar. 28, 1957.

NSA Vol. 11, No. 23 Suppl., p. 1542. In abstract 13849, in descriptive cataloging, KD-630-2(Del.) should be KD-631-2 (Del.).

NSA Vol. 11, No. 23 Suppl., p. 1551. In abstract 13916, COO-208(Del.) should be COO-208(Del. 2), and secondary number RD-346(Del.) should be RD-346(Del.2).

NSA Vol. 12, No. 2 Suppl., p. 249. In abstract 2182, NAA-SR-75(Del.) should be NAA-SR-75(Del.2).

NSA Vol. 12, No. 3, p. 254. In abstract 2211, For preceding period see AECU-3531 should be For preceding period see AECU-3581.

NSA Vol. 12, No. 6, p. 462. In abstract 4121, line five, liquid salt extrusion ... should be liquid salt extraction ....

NSA Vol. 12, No. 8, p. 600. In abstract 5310, title of report, RESUME OF URANIUM OXIDE DATA—VII should be RESUME OF URANIUM OXIDE DATA—VIII.

NSA Vol. 12, No. 12A, p. 935. In abstract 8200, CF-52-5-1(Pt.II)(Del.) should be CF-52-5-1(Pt.11)(Del.).

NSA Vol. 12, No. 18, p. 968. In abstract 8428, title of report, REPORT ON WAGON DRILLING FOR URANIUM IN THE SILVER REEF(PHARRISBURG) DISTRICT, WASHINGTON COUNTY, UTAH. SHOULD BE REPORT ON WAGON DRILLING FOR URANIUM IN THE SILVER REEF (HARRISBURG) DISTRICT, WASHINGTON COUNTY, UTAH.

NUCLEAR SCIENCE ABSTRACTS

Volume 12 Number 17 September 15, 1958

GENERAL

Atomic Bombs and Warfare

Refer also to abstract 11234.

11205

ON THE EFFECTS OF NUCLEAR TESTS. PHYSICO-CHEMICAL FACTORS. J. Gueron. Science et technique. 4p. [(1957)]. (In French)

The estimates of the amount of nitrogen oxide formed in a nuclear test are discussed and shown to be in excess by a factor of between 10 and 50. The amounts of nitric acid resulting from this nitrogen oxide are negligible by comparison with those formed during storms; furthermore, the acid so formed, if carried down by rain, is easily neutralized by the lime found in soils. The ultramicro-droplets which would form around each molecule of nitric acid in nuclear tests and which have been suggested as being drought-inducing, seem much too dilute in nitric acid to be considered as essentially different from ultramicro-droplets formed around any other condensation nucleus. (auth)

Atomic Power

11206

ECONOMICS OF NUCLEAR SHIPS. T. J. Connolly (Univ. of California, Los Angeles) and Jens Wilhelmsen, Jr. (Fredrikstad Mek. Verksted, Fredrikstad, Norway). Atomics and Nuclear Energy 9, 151-5(1958) May.

The great success of the U. S. submarine Nautilus and the Suez crisis, which showed what advantages might arise from large atom-powered tankers, are two events which have spurred the nations of the world to investigate the feasibility of nuclear power for propulsion at sea. The technical feasibility of nuclear-powered sea vessels has been clearly established, but the economical and safety factors are matters still not completely investigated. The conditions of capital and fuel cost for competitive nuclear ship propulsion and the possibilities for achievement of these conditions are discussed. (A.C.)

11207

SHIP PROPULSION BY NUCLEAR POWER. 1. K. Illies (Univ. of Hamburg and Hanover Tech. Univ.). Atomics and Nuclear Energy 9, 156-9, 184(1958) May.

An assessment is given of the practicability of nuclear power to ships fitted with gas turbines, with special reference to tankers. (A.C.)

11208

O.M.R. AND SHIP PROPULSION. F. R. Paulsen. Atomics and Nuclear Energy 9, 160-2(1958) May.

A reactor system cooled and moderated by an organic liquid has many advantages and is one of the favored possibilities for marine propulsion in the U.S.A. It offers economy, ease of operation, and safety. The advantages inherent in nuclear propulsion units for long periods of operation when the cargo is not likely to undergo severe changes are discussed. (A.C.)

11209

C.C.G.C. REACTOR FOR SHIPS. Atomics and Nuclear Energy 9, 162-3(1958) May.

Although the nuclear engines of U. S. submarines have proved the possibility of atomic power for ship propulsion, it is desirable to find quickly one or more cheaper and more efficient marine engines based on nuclear power. The U. S. is exploring every possible system. A study is being made of a closed-cycle gas-cooled reactor with the object of incorporation into a tanker by 1961. In spite of its many difficulties, the closed-cycle gas-cooled reactor offers the big advantage of high efficiency. (A.C.)

11210

ATOMIC ENERGY IN ITALY IN 1958: POLITICAL-ECONOMIC PROBLEMS OVERSHADOW PROGRESS. Stelio Villani. Atomwirtschaft 3, 196-8(1958) May. (In German)

The development of nuclear energy in Italy is overshadowed by economic arguments between the champions of private enterprise and those of state monopoly, since it has been recognized that in an industrialized country the utilization of atomic energy will be of vital future importance. Italian atomic research was continued after the war, especially in the field of applied research and atomic engineering, at CISE, Milan, which was started by both private and official groups. (auth)

11211

DOES AUSTRIA NEED ATOMIC POWER? Albert Wietz. Atomwirtschaft 3, 203-4(1958) May. (In German)

In spite of considerable unexploited hydraulic power the first nuclear power station in Austria must be completed by 1956. The hydraulic power available exceeds summer energy requirements but is insufficient in the winter, and Austria has only small coal and natural gas deposits. (auth)

11212

NEW DEVELOPMENTS OF THE BRITISH NUCLEAR POWER PROGRAM. J. Cockcroft. Energia nucleare (Milan) 5, 353-60(1958) June. (In Italian)

A brief summary is given of the British developments in nuclear power to the present, and an outline is presented of the proposed future developments. (J.S.R.)

11213
PERSPECTIVES OF NUCLEAR POWER IN CLOSED CYCLE GAS TURBINES. A. I. Mikhailov (Machine Lab., Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk No. 1, 113-19(1958) Jan. (In Russian)

Data are presented on the analysis of a double-contour closed-cycle gas turbine power plant using helium, nitrogen, or carbon oxide gases as working fluid and a sodium-cooled reactor as a heat source. (R.V.J.)

11214
A UNIVERSAL SOURCE OF ENERGY. J. V. Dunworth (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Joint Panel Nuclear Marine Propulsion No. 2, 24-6(1957) Oct.

The various uses proposed for atomic energy and their feasibility are reviewed on the basis of present knowledge. (T.R.H.)

11215
WORLD PROGRESS WITH THE ATOM, SINCE GENEVA. Ashton J. O'Donnell. J. Joint Panel Nuclear Marine Propulsion 2, 46-51(1958) Apr.

The progress in development and use of nuclear power in England, Japan, the Euratom Countries, France, Italy, Norway, Sweden, the Netherlands, Taiwan, Denmark, and underdeveloped countries is summarized. Developments in nuclear propulsion in Norway, Holland, Italy, France, Japan, England, Sweden, Denmark and Greece, and Germany are briefly discussed. (T.R.H.)

11216
UNITED KINGDOM ATOMIC ENERGY AUTHORITY THIRD ANNUAL REPORT FOR THE PERIOD 1st APRIL 1956–31st MARCH 1957. London, Her Majesty's Stationery Office, 1957. 64p. $0.54.

Developments in the United Kingdom's nuclear power program during 1956 and 1957 are reported. Two nuclear weapons trials were held, and preparations were made for a third series of tests. Important steps were taken towards ensuring the United Kingdom's future uranium supplies both for defense and civil uses. The Calder Hall nuclear power station was opened, and contracts were placed for the erection of two English nuclear power stations. Provisional arrangements were announced for the construction of a Scottish station and a possible third English one. Plans were developed for the building of the land-based prototype of a reactor for submarine propulsion. (C.H.)

11217
ATOMIC ENERGY IN SPAIN. R C N Bull. 2, 57-9 (1958) May. (In Dutch)

The development of atomic power in Spain is briefly discussed. The discussion includes mention of mineral resources, heavy water production, reactors, research centers, and planned installations. (J.S.R.)

Research Programs

11218
DESIGN PRINCIPLES FOR THE JOINT ATOMIC RESEARCH CENTER OF THE NORTH RHINE-WESTPHAL REGION. H. B. Speicher. Atomwirtschaft 3, 218-23 (1958) June. (In German)

The building operations for the joint atomic research station of the North Rhine-Westphalia region have commenced in the Stetternich Forest near Juelich. It is intended to put at the disposal of all the universities of the region the expensive research tools needed, and to avoid centralization and specialization. A wide program which leaves room for great expansion at a later date has been planned for the institute to give all the students in North Rhine-Westphalia the opportunity to get training in nuclear physics, chemistry, and engineering. The following details are discussed in the article: local conditions, planning, safety measures, central supply arrangements, and the principles which have governed the standardization of the building operations of the institute. (auth)

11219
FUSION POWER. Richard F. Post. Sci. American 197, 73-84(1957) Dec.

The phenomenon of nuclear fusion is discussed. The feasibility of applications in the development of thermonuclear power are considered. The status of unclassified research programs throughout the world is summarized. (C.H.)

BIOLOGY AND MEDICINE

11220
RESPIRATORY PROTECTION EQUIPMENT DEVELOPMENTS BY THE U. S. ARMY CHEMICAL CORPS. Allan L. West (Army Chemical Center, Md.). Am. Ind. Hyg. Assoc. J. 19, 140-8(1958) Apr.

In addition to its mission of developing respiratory protective equipment for protection of the United States armed forces against the hazards of toxicological warfare agents, the U. S. Army Chemical Corps has the responsibility for the procurement, storage, and issue of several types of safety and rescue type respiratory protective equipment for use by agencies of the Department of Defense. An illustrated discussion is presented on the following classes of individual respiratory protective equipment which have been standardized by the U. S. Army Chemical Corps: military protective masks, special purpose gas masks, self-contained breathing apparatus, dust masks and paint spray respirators. Also discussed are two experimental protective masks developed by the Chemical Corps for the Federal Civil Defense Administration. The procedures used by the Chemical Corps in undertaking the development and testing of new items of respiratory protective equipment are briefly described. (auth)

11221
THE RESPIRATOR PROBLEM, AN INDUSTRIAL HYGIENIST'S VIEWPOINT. Harry S. Jordan (Los Alamos Scientific Lab., N. Mex.). Am. Ind. Hyg. Assoc. J. 19, 149-53(1958) Apr.

Problems in the development and testing of respiratory protective equipment are summarized. (C.H.)

11222
NUCLEAR-TRACK TECHNIQUE FOR LOW-LEVEL Pu IN URINE. L. C. Schwendiman and J. W. Healy (General Electric Co., Richland, Wash.). Nucleonics 16, No. 6, 78, 80-2(1958) June.

The plutonium, after separation from a urine sample, is electrodeposited on a metal disk. The disk is held against a nuclear-track emulsion for 168 hrs. After emulsion development, tracks are counted under a microscope. The detection limit of less than 0.05 disintegrations per minute currently achieved on a routine basis is low enough to permit early recognition of low-level plutonium ingestion. (W.D.M.)

11223
MICROBIOLOGICAL FRACTIONATION OF THE HYDROGEN ISOTOPES. P. E. Gloud, Jr., Irving Fried-

man, and F. D. Sisler (U. S. Geological Survey, Washington) and V. H. Dibeler (National Bureau of Standards, Washington). Science 127, 1394-5(1958) June 13.

As a part of a comprehensive plan of study of Bahamas sediments collected in May 1955, bacteriological analyses of the refrigerated samples were undertaken, beginning early in 1956. It was soon observed that a yet unidentified facultative aerobe found in teeming abundance in aragonite muds from a mid-bank locality west of Andros Island produced gas vigorously when it was cultured in a dextrose medium. It seemed likely that this gas was largely CO_2, but a check-analysis was sought from the Mass Spectrometry Section of the National Bureau of Standards. That analysis showed 26.3% carbon dioxide and 63.4% hydrogen; the latter, within the resolving power of the apparatus, appeared to consist exclusively of common light hydrogen. The balance was 5.3% water vapor, 4.6% nitrogen, and 0.4% oxygen. (auth)

Radiation Effects

11224 AF-SAM-57-59
Texas. Univ., Austin and School of Aviation Medicine, Randolph AFB, Tex.
LATENT EFFECTS OF CHRONIC WHOLE-BODY IRRADIATION OF MONKEYS WITH MIXED SOURCE RADIATION. Roger T. Davis, Claude B. Elam, and Arnold A. McDowell. Feb. 1958. 33p.

Monkeys were studied on learning tasks given $5\frac{1}{2}$ months before, $7\frac{1}{2}$ months during, and $13\frac{1}{2}$ months after chronic mixed source irradiation. The results indicated no significant dose response in learning tasks. A syndrome of changes was noted: irradiated animals had significantly different food preferences from the controls; animals receiving the higher radiation doses showed stronger preferences for food in lower spatial quadrants than did control and lower dose group animals; irradiated animals made more cage-directed, but fewer rapid-energy responses than did control group animals; and control animals were more distracted by extraneous sounds, both in the free cage and under formal laboratory task situations. (auth)

11225 AF-SAM-58-63
School of Aviation Medicine, Randolph AFB, Tex.
SOME PERSISTING EFFECTS OF NUCLEAR RADIATION EXPOSURE ON THE BEHAVIOR OF THE RHESUS MONKEY. A. A. McDowell and W. Lynn Brown. Apr. 1958. 4p.

Ten 10-minute observations were made of the free-cage behavior of each of 48 monkeys during days 31 through 60 following exposure of 40 of the monkeys to a nuclear detonation. It was found that the frequency of responses to body parts was significantly greater for the irradiated animals than for the control animals. The frequency of defecation under the experimental conditions was also significantly greater for the irradiated animals than for the control animals. (auth)

11226 AF-SAM-58-73
Texas. Univ., Austin and School of Aviation Medicine, Randolph AFB, Tex.
A COMPARISON OF NORMAL AND IRRADIATED MONKEYS ON AN ODDITY-REVERSAL PROBLEM. A. A. McDowell and W. Lynn Brown. Jan. 17, 1958. 5p.

Normal, low-dose irradiated, and high-dose irradiated monkeys were tested on an oddity-reversal problem which used the same stimulus cues in antagonistic response patterns. Originally, each animal was tested 24 trials a day to the criterion of two successive days with two errors or fewer a day on response to the object which was odd in color. In reversal training, each animal was tested to the same criterion on response to the object which was odd in form. Among the groups, no consistent differences were observed in the number of errors made in reaching either the pre- or postreversal criterion. All groups showed a statistically significant increase in errors to criterion on reversal learning over errors to criterion on original learning. There was a statistically significant difference in negative saving scores, indicating the superiority of the irradiated animal over the normal animal with respect to reversal problems of this type. (auth)

11227 AMRL-344
Army Medical Research Lab., Fort Knox, Ky.
EFFECTS OF X-RAYS ON ISOHEMAGGLUTININS. A. J. Luzzio. July 18, 1958. 12p. Project No. 6-59-08-014.

Exposure of human red blood cell agglutinins in immune sera to x rays resulted in the inactivation of specific groups. Other blood group determining sites remained unaffected at the same dose levels. The results indicate that various antibody-combining sites possess specific radiosensitivities. Practical applications to studies on antibody structure and sterilization of immune blood proteins are discussed. (auth)

11228 AMRL-345
Army Medical Research Lab., Fort Knox, Ky.
ALTERATIONS BY IODINE-131 DISTRIBUTION IN THE RAT AFTER WHOLE BODY X-IRRADIATION. D. D. Ulmer, L. B. Perkins, and J. G. Kereiakes. July 24, 1958. 18p. Project No. 6-59-08-014.

Twenty-four hours after exposure of rats to whole body x irradiation and injection of I-131 the stomach contents and pelt showed a marked increase in concentration of radioiodine. The blood and other organs showed less marked increases as compared to non-irradiated controls. X irradiation diminished the amount of I-131 lost into the urine and feces. (auth)

11229 ORNL-2533
Oak Ridge National Lab., Tenn.
EVIDENCE FOR THE UNIFORM RADIATION LIFE SHORTENING PREDICTED BY INFORMATION THEORY (thesis). J. S. Mendell. June 26, 1958. 67p. Contract W-7405-eng-26. $2.00(OTS).

Information theory was developed by electrical engineers to provide the most efficient way of expressing a message for use in transmission systems. The mathematics of information theory is discussed. Yockey demonstrated that information entropy, conditional entropy, read-off error, and other information theoretical ideas have counterparts in genetic systems. Information theory was applied in an analysis of data on radio-induced life shortening. (C.H.)

11230 ORO-175
Arkansas. Univ., Little Rock. School of Medicine.
STUDIES ON THE BIOCHEMICAL AND NUTRITIONAL ASPECTS OF X-IRRADIATION INJURY. Final Scientific Report, July 1, 1951—August 31, 1957. Paul L. Day, F. Douglas Lawrason, and John Tyler Caldwell. May 1, 1958. 6p. Contract AT(40-1)-1315. $1.80(ph OTS); $1.80(mf OTS).

Results are summarized from studies on the biochemical effects of irradiation on chicks, rats, and rabbits. A list of publications during the period is included. (C.H.)

11231 AEC-tr-3272

A COMPARISON OF THE BIOLOGIC[AL] ACTION OF X-RAYS AND THE RADIATION OF RADIOACTIVE COBALT. S. N. Aleksandrov (Alexandrov), K. F. Galkovskaya (Halkovskaya), and Yu. G. Zil'berg. Translated from Med. Radiol., No. 2, 80-7(1956). 9p.

The biological effects of Co^{60} gamma radiation and x radiation on mice were compared by determining the life span, survival time, leukocyte count, and incidence of malignant tumors following irradiation. (C.H.)

11232 AERE-Lib/Trans-785

THE INFLUENCE OF IRRADIATION WITH RADIOACTIVE COBALT Co^{60} ON VITAMIN C CONTENT IN POTATOES. E. G. Sal'kova. Translated by T. Turton (U.K.A.E.A., Atomic Energy Research Establishment) from Doklady Akad. Nauk S.S.S.R. 114, 757-9(1957) 4p.

An early and a medium-late variety of potato were irradiated using Co^{60} (10,000 r), and the effect on vitamin C content was studied in connection with potato storage research. Vitamin C oxidation takes place immediately upon irradiation, but the difference in content between control and irradiated potatoes vanishes with prolonged storage. The irradiated potatoes were in an excellent state of preservation at one year while the controls had sprouted and were of no food value. (T.R.H.)

11233

SOME EFFECTS OF GAMMA RADIATION ON TROGODERMA STERNALE JAYNE. H. F. Howden and S. I. Auerbach (Univ. of Tennessee, Knoxville and Oak Ridge National Lab., Tenn.). Ann. Entomol. Soc. Am. 51, 48-51(1958) Jan.

Some of the aspects of the biology of Trogoderma sternale and the effects of single and fractionated doses of gamma radiation on reproduction and larval development are discussed. (auth)

11234

CRITERIA FOR ESTABLISHING SHORT TERM PERMISSIBLE INGESTION OF FALLOUT MATERIAL. Gordon M. Dunning (Atomic Energy Commission, Washington). Am. Ind. Hyg. Assoc. J. 19, 111-20(1958) Apr.

Criteria are summarized for use in establishing permissible limits for ingested radioactive fall-out material under emergency conditions for several weeks following a nuclear detonation. Data on possible biological effects of various dose levels are tabulated. 30 references. (C.H.)

11235

IRRADIATION OF DEVELOPING PLANT EMBRYOS. I. EFFECTS OF EXTERNAL IRRADIATION (X RAYS) ON BARLEY EMBRYOGENY, GERMINATION, AND SUBSEQUENT SEEDLING DEVELOPMENT. Leo W. Mericle and Rae Phelps Mericle (Michigan State Univ., East Lansing). Am. J. Botany 44, 747-56(1957) Nov.

Barley embryos in varying stages of development were subjected in situ to single doses of x radiation of 50 to 800 r. At intervals following irradiation, part of the developing grains were sampled for histologic examination; those remaining were allowed to mature so that effects of irradiation could be followed on their subsequent germination and seedling development. In the histological study, irradiation effects increased in number and severity with an increase in radiation level. Evidence from the germination-seedling study indicates the occurrence of hidden effects. (C.H.)

11236

THE EFFECT OF PROPYL THIOURACIL ON THE RECOVERY OF RAT THYROID GLAND FROM IRRADIATION WITH ASTATINE-211. Patricia W. Durbin, C. Willet Asling, Muriel E. Johnston, and Joseph G. Hamilton (Crocker Radiation Lab. and Univ. of California, Berkeley and San Francisco). Anat. Record 129, No. 1, 17-37(1957) Sept.

The weight, histology, and iodine-131 uptake by thyroid gland in young female rats were studied for one month following induction of hyperplasia by the feeding of propylthiouracil, radiation damage induced by injection of astatine-211, and a combination of the two treatments. Systematic data were accumulated on the capacity of the thyroid gland to recover both functionally and structurally from a moderately injurious dose of astatine-211, and of the effects of propylthiouracil pretreatment on that recovery. (C.H.)

11237

EFFECTS OF RADIOCOBALT IRRADIATION OF RABBIT SPERMATOZOA IN VITRO ON FERTILIZATION AND EARLY DEVELOPMENT. M. C. Chang, Dorothy M. Hunt, and E. B. Romanoff (Worchester Foundation for Experimental Biology, Shrewsbury and Boston Univ., Mass.). Anat. Record 129, No. 2, 211-29(1957) Oct.

Rabbit semen irradiated with gamma radiation from a Co-60 source in vitro at 90 r to 65,000 r was inseminated artificially to females. The ova were examined at pronuclear, segmentation, blastocyst, and late fetal stages. The motility of spermatozoa was damaged only at very high doses of irradiation, 32,200 to 65,000 r. Though incapacity of sperm to reach the site of fertilization may occur at these dose levels, the fertilizing capacity per se appears to be undamaged. The segmentation of fertilized ova was very much disturbed. The disturbance is in proportion to the dose level and the higher the dose level the earlier the failure of segmentation. With irradiation of sperm at 90 r, the proportion of morphologically normal fetuses is not significantly lower than after normal mating; following irradiation of sperm at 800 r the formation of normal blastocysts was impaired but once a normal blastocyst is formed implantation and development are assured; following irradiation of sperm at 6,500 r, no normal blastocyst is formed. Delayed penetration of sperm, a high proportion of polyspermic ova, haploidy and triploidy of ova, and delayed syngamy were not observed following the irradiation of sperm at 32,200 to 65,000 r. Fragmentation of female and male pronuclei, an irregularity of nucleus formation at segmentation, and one possible gynogenetic ovum out of 32 ova were observed. (auth)

11238

ERYTHROPOIESIS IN RADIATION DISEASE COMBINED WITH BURN. I. T. Abasov (Azerbaidzhan Inst. for Research in Roentgenology and Radiology). Bull. Exptl. Biol. Med. (USSR) (English Translation) 43, 799-801 (1957) July.

Experiments with radioactive iron have demonstrated that in rats subjected to x-ray irradiation (500 r) erythropoiesis is for the first ten days inhibited, and restored at the end of the first week. In rats with burns of the distal parts, caused by boiling water, erythropoiesis is enhanced during the first days and then with the development of inflammatory complications, is inhibited, not being restored even at the end of two weeks. In animals subjected to both irradiation and burns, release of erythrocytes ceases almost completely and in surviving ones restoration of erythropoiesis proceeds very slowly. (auth)

11239

CHANGES IN THE ANTIGENIC PROPERTIES OF TUMOR CELLS UNDER THE EFFECT OF X-RAYS IN

VITRO. I. N. Maisky and G. V. Suvorova (Inst. of Experimental Biology, AMS, USSR, Moscow). Bull. Exptl. Biol. Med. (USSR) (English Translation) 44, 1121-3 (1957) Sept.

Changes in the antigenic properties of tumor cells induced by in vitro exposure to x radiation were demonstrated by observations on the anaphylactic reaction following injection in guinea pigs. Guinea pigs sensitized and desensitized with non-irradiated ascitic cells served as controls, as did guinea pigs which were used for testing the toxicity of the doses. (C.H.)

11240

A STUDY OF THE RADIATION INJURIES IN FISH IN EARLY DEVELOPMENT STAGES. A. A. Neifakh and N. N. Rott (Inst. of Animal Morphology, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 119, 261-4(1958) Mar. 11. (In Russian)

The fertilized eggs of Misgurnus fossilis and Acipenser stellatus were x-irradiated with 10,000 r in various stages of development (from fertilization to the middle gastrulation). The high doses were selected for the purpose of obtaining a simultaneous stage-connected reaction of all embryo. Graphical analysis of their development after exposure, based on length of embryo survival, and changes in the latent periods is included. (R.V.J.)

11241

X-RAY INDUCED HEREDITARY CHANGES IN YEAST ORGANISMS ACCUMULATING INCREASED AMOUNTS OF ERGOSTEROL. E. N. Sokurova (Inst. of Microbiology, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 119, 265-6(1958) Mar. 11. (In Russian)

Cultures of Saccharomyces carlsbergensis Frohberg possessing high ergosterol content (about 2% of dry weight in 2-day cultures in wort-agar medium) were selected for the study. The results showed that it is possible to obtain yeast culture with hereditary fixed increase of ergosterol by irradiation with sublethal doses and subsequent selection. However, the hereditary fixation is not strong enough to withstand continuous cultivation without repeated irradiation. The radiosensitivity of the yeast with increased ergosterol does not change, though ergosterol shows promise as a radiation protection agent. (R.V.J.)

11242

USE OF SERUM FROM IRRADIATED RABBITS AND GUINEA PIGS AS COMPLEMENT IN BACTERICIDAL REACTIONS. Lottie Kornfeld (Univ. of Chicago). J. Bacteriol. 74, No. 6, 830-1(1957) Dec.

The preparation of serum for use in complement fixation studies is simplified by the in vivo radioinduced inactivation of normal antibodies in the blood of donor animals. Normal bactericidins for Bacillus subtilis disappeared from the sera of rabbits and guinea pigs following exposure to doses of x radiation ranging from 200 to 1000 r. The optimum time for bleeding seemed to depend on the size of the animal. Results are presented for bactericidal tests with a normal mouse serum pool in the presence of complements from several sources. A more sensitive reaction was obtained with serum from irradiated animals. (C.H.)

11243

THE EFFECTS OF HEAVY GAMMA IRRADIATION UPON PITUITARY GLANDS TRANSPLANTED INTO HYPOPHYSECTOMIZED TADPOLES OF BUFO BOREAS. Bennet M. Allen (Univ. of California at Los Angeles). J. Exptl. Zool. 136, No. 1, 185-98(1957) Oct.

The pituitary gland retains its ability to secrete thyrotrophic hormone and intermedin up to 108 days after very heavy irradiation. In these experiments hypophysectomy had been performed as usual on tadpoles at the tail bud stage and the pituitary glands of irradiated recently metamorphosed toads were transplanted into them after they had reached a trunk length of 6 to 8 mm. The activity of the transplant was largely conditioned by the amount of trauma that occurred in the operation. In more favorable cases the pars anterior produced thyrotrophic hormone sufficient to induce the thyroid gland of the hosts to secrete enough hormone to cause well advanced development toward metamorphosis by the end of 42 days. Tadpoles killed at 108 days show still further average development. The thyrotrophic function of the pars anterior was maintained after an irradiation of 27,000 r but it is probable that a still heavier irradiation would not have completely destroyed its capacity to secrete during this period of time. Color change induced by the secretory activity of the pars intermedia is very pronounced at 45 minutes after transplantation and continues through the 108 days of the experiment. These color effects are fully maintained in spite of an irradiation of 27,000 r only slight diminution resulting from a dosage of 40,000 r. (auth)

11244

ANTIBODY RESPONSE OF MICE TREATED WITH 2-MERCAPTOETHYLGUANIDINE HYDROBROMIDE AND LETHAL DOSES OF X-RADIATION, AND ITS SIGNIFICANCE TO THE RELATION OF ANTIGEN TO HOST. Takashi Makinodan, Isabel C. Shekarchi, and Charles C. Congdon (Oak Ridge National Lab., Tenn.). J. Immunol. 79, 281-7(1957) Oct.

No important difference between sheep and rat agglutinin production was observed in normal and MEG (2-mercaptoethylguanidine hydrobromide) treated mice. The sheep agglutinin response was higher than rat agglutinin response in the 475-r, 700-r, 950 r-IBM (isologous bone marrow) treated, and MEG-950 r mice. Such difference was based on the induction period of agglutinin response, peak agglutinin titer, and on the mean total agglutinin response. The rate of recovery of the immune mechanism of MEG-950 r mice was almost comparable to that of the 475-r mice. The rate of recovery of the immune mechanism of MEG-950 r mice was not significantly different from that of the 950 r-IBM mice. The results permit the deductions that MEG protects predominantly nonantibody producing cells; that either multiple types of antibody producing cells exist or some antibody producing cell has the ability to recognize the difference between homologous, closely related heterologous, and distantly related heterologous antigens; and that the degree of destruction of antibody forming cells by x-irradiation is in the order mentioned. (auth)

11245

RELATION OF PRIMARY ANTIGEN INJECTION TO TIME OF IRRADIATION ON ANTIBODY PRODUCTION IN MICE. Nazareth Gengozian and Takashi Makinodan (Oak Ridge National Lab., Tenn.). J. Immunol. 80, No. 3, 189-97(1958) Mar.

Normal mice were injected intraperitoneally with 1 ml of 1% sheep red blood cell antigens (RBC) at intervals of from 10 days before to 45 days after exposure to 710 r of x rays. Antibody response was measured in terms of induction period, rate of appearance of circulating antibody, mean peak titer, time of peak titer, and mean total titer. The immune mechanism was depressed in both the pre- and postirradiation antigen-injection groups. The degree of this inhibition varied for the different criteria of antibody response and was also de-

pendent on the temporal relation of x irradiation and antigen injection. Maximum immunologic depression occurred in mice receiving antigen 5 min to 1 day after x irradiation. Although there was a progressive increase in the response to antigen as the interval between x irradiation and antigen injection was increased, the immune mechanism of irradiated mice never returned to a completely normal status. Converse to the general inhibitory effect of radiation, mice receiving 710 r of x rays 5 days after antigen injection showed above normal mean peak and mean total agglutinin titers. Irrespective of the temporal relation of x irradiation and antigen injection, analysis of the data indicates that x irradiation does not affect the different indices of antibody formation to the same extent. (auth)

11246

THE CARDIOVASCULAR EFFECTS OF IONIZING RADIATIONS. Durwood J. Smith (Univ. of Vermont, Burlington). J. Maine Med. Assoc. 4p. (1958) June.

Present knowledge concerning the effects of atomic radiations upon the cardiovascular system of men and animals is reviewed. Data from experimental and clinical studies are cited in an attempt to integrate isolated observations into a comprehensive presentation of the over-all effects of ionizing radiations upon the cardiovascular systems. (C.H.)

11247

RADIATION PROCESSING OF FOODS. Raymond J. Beeley (Atomics International, Canoga Park, Calif.). Nuclear Sci. and Eng. 3, 660-93(1958) June.

In a study made for the U. S. Army Quartermaster Corps, all of the known types of radiation sources of sufficient size to be of interest in large scale radiation processing were compared. The sources considered are spent fuel elements from a power reactor, fission product gases from a fluid-fuel reactor, separated fission product Cs^{137}, reactor-coolant Na^{24}, neutron-activated In^{116m}, charged particle accelerators, and x-rays. The results are summarized. (auth)

11248

COMPARISON OF THE GENETIC EFFECTS OF 31-Mev BETATRON RADIATION WITH 180-kev X RADIATION BY PRODUCTION OF VISIBLE RECESSIVE MUTATIONS AND GYNANDRY IN THE DROSOPHILA MELANOGASTER. W. Schmid (Univ. of Zurich). Oncologia 11, 218-43(1958). (In German)

A total of 888 male Drosophila, of a wild inbred strain, were exposed to 200 r x radiation. Part of the group were exposed to 180 kev and the remainder to high voltage 31 Mev radiation from a betatron. Equal and constant biological-physical experimental conditions were maintained. After mating with females homozygous for five factors, the descendants were examined for radioinduced visible, recessive mutations. There appeared to be no essential quantitative effect in the genetic effect of the two qualities of radiation. (C.H.)

11249

TRANSFORMATION OF LEUKOPENIA INTO ACUTE LEUKEMIA IN AN X RAY TECHNICIAN. B. Sklensky, A. Boleslav, and H.Dostalova. Pracovni Lekarstvi. Praha No. 1, 57-61(1958) Jan. (In Czech.)

A case history is given of a technician exposed for 10 years to x radiation during her work in a laboratory where safety rules and preventative measures were not observed. A gradual decrease of leucocyte count along with subjective complaints were observed in 1953. In May 1953, a multiplication of immature leukocyte forms were observed both in the marrow and peripheral blood. By October of the same year there was an influenza-like clinical picture associated with a hematological transformation into an acute paramyeloblastic leukemia. The patient died in March 1957. The clinical course of the leukemia was somewhat different from idiopathic acute leukemia. (tr-auth)

11250

A STUDY OF THE EFFECT OF GAMMA RADIATION ON APPLES. R. M. Smock and A. H. Sparrow (Cornell Univ., Ithaca, N. Y. and Brookhaven National Lab., Upton, N. Y.). Proc. Am. Soc. Hort. Sci. 70, 67-9 (1957).

Gamma radiation (cobalt source) of Rhode Island Greening apples did not lower the respiration rate. The 40,000 r lot had a higher than normal rate. This lot also softened more during the holding period at 74°F. Dosages over 10,000 r seemed to aggravate mealy breakdown. Dosages of 20,000 and 40,000 r reduced the production of ethylene and volatiles other than ethylene. The respiration rate of Cortland apples was reduced slightly by gamma radiation. Keeping quality of this variety in storage was not affected, except for the 30,000 r lot which was slightly softer. Weight losses were not affected by radiation. No commercially important benefits were observed with either variety. (auth)

11251

NUCLEONICS PANEL ON HARMFUL EFFECTS OF IRRADIATION ON HEMOPOIESIS AND ITS ACCELERATED RESTORATION. Eugene P. Cronkite (Brookhaven National Lab., Upton, N. Y.). pp. 370 in "Proceedings of the 6th International Congress of Hematology." New York, Grune and Stratton, 1958.

Studies engaged in from 1912 to 1935 on the effects of radiation on the hematopoietic system are briefly reviewed. (C.H.)

11252

ACUTE EFFECTS OF IRRADIATION IN MAN. G. A. Andrews (Oak Ridge Inst. of Nuclear Studies, Tenn.). pp. 371-82 in "Proceedings of the 6th International Congress of Hematology." New York, Grune and Stratton, 1958.

An attempt is made to chart the hematologic response of a hypothetical patient to a large, but not lethal, dose of total-body irradiation given over a short period of time. The data, which are compiled from many sources, indicate that there is a definite sequence of changes with a distinct delay in production of the most profound manifestations of hematopoietic change. 36 references. (C.H.)

11253

DAMAGE TO OFFSPRING OF IRRADIATED WOMEN. Irwon H. Herskowitz. Progr. in Gynecology 3, 374-84 (1957).

Possible radiation hazards to the developing fetus due to diagnostic and therapeutic radiography are discussed. The pathological effects of radiation on the gonads are reviewed. (C.R.)

11254

SPECIFIC QUESTIONS OF RADIATION PROTECTION OF THE POPULATION. Hermann Muth (Max Planck-Inst. für Biophysik, Frankfurt a. M.). Strahlentherapie 106, 58-69(1958). (In German)

The problem of exposure to ionizing radiation of the whole population is discussed with special regard to genetic questions. The exact value of the dose which doubles the spontaneous mutation rate in man cannot yet be given. The proposed figure of 10 rem within 30 years

as gonad dose is discussed. The possible influences of high energy rays on the population as a consequence of peaceful or military use of nuclear energy are also discussed. (auth)

11255
THE EFFECT OF THERAPEUTIC RADIOIODINE ON THE HORMONE IODINE SYNTHESIS OF THE THYROID GLAND. Wolfgang Horst, Robert Prévôt, and Herbert Franke (Universitats-krankenhaus, Hamburg-Eppendorf, Germany). Strahlentherapie 106, 139-48(1958). (In German)

The influence of therapeutic doses of radioiodine on the synthesis of thyroid hormones is discussed. (C.H.)

11256
THE RELEASE OF THE FEELER REFLEX IN SNAILS BY X AND ALPHA RADIATION. Otto D. Hug (Phil.-Theol. Hochschule, Regensburg, Germany). Strahlentherapie 106, 155-60(1958). (In German)

In different European land and water snails, reflex retraction of the feelers was observed under exposure to x or alpha rays. In respect of the relations hitherto observed between dose rate and exposure time on the one hand and latency and the strength of the reflex on the other hand, the phenomenon has the character of a stimulus response. Ionizing radiations must therefore be considered as stimuli from the point of view of nerves physiology, either in the sense that they imitate the effect of adequate stimuli on specific photo- or chemoreceptors, or in the sense, that they have a general effect in the manner of an inadequate stimulus on the nervous substance of the animal species under observation. As radiation doses of even a few r produce an effect, this early reaction, which can be easily observed, is among the most sensitive radiobiological tests. (auth)

Radiation Hazards and Protection

11257 AFSWC-TN-57-30
Air Force Special Weapons Center, Kirtland AFB, N. Mex.
LIMITS FOR RADIATION CONTROL AND RELEASE OF AIR FORCE MATERIAL CONTAMINATED WITH FISSION PRODUCTS. James L. Dick and William R. Hurdlow. Apr. 1958. 42p. Project No. 7806. (AD-157163).

Supersedes AFSWC-TN-56-2.

Personnel working with aircraft and aircraft parts contaminated by mixed fission product debris are exposed to external and internal radiation hazards. Experiments have shown that the external hazard is, in every conceivable case, the limiting hazard for establishing safety precautions. Therefore, a beta-gamma survey of contaminated materials will be sufficient to determine if the material is to be released to an uncontrolled area. The dose rates from a decaying fission product mixture must be evaluated in terms of the age of the mixed fission products if one is to establish the true magnitude of the hazard. The range of external beta-gamma radiation measurements which will result in an integrated dose to human skin of no more than 1 rem/year for a continuous 168 hr/wk exposure is 3.6 mrad/hr for materials contaminated with fission products 1 week old or less, to 0.25 mrad/hr for material contaminated with fission product greater than 3 years old. (auth)

11258 SCTM-217-58(51)
Sandia Corp., Albuquerque, N. Mex.
TESTIMONY DURING SHELTER HEARINGS OF THE MILITARY OPERATIONS SUBCOMMITTEE. L. J. Vortman. May 1958. 30p. Contract AT(29-1)-789. $4.80(ph OTS); $2.70(mf OTS).

Those full-scale effects tests which relate to protective shelter construction are summarized. Principles of shelter design are discussed. Based on costs of two shelters built at the Nevada Test Site, the cost in dollars and time of a national personnel shelter program is estimated. (auth)

11259 WAPD-CTA(IH)-208
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PRE-OPERATIONAL RADIATION SURVEY OF THE SHIPPINGPORT ATOMIC POWER STATION SITE AND SURROUNDING AREA. Jan. 1958. 88p. Contract AT-11-1-GEN-14. $13.80(ph OTS); $4.80(mf OTS).

The results of extensive measurements of radioactivity in the physical environment of the Shippingport Pressurized Water Reactor are presented. Data on fall-out, soil, Ohio River water, gamma and beta-gamma background monitoring, continuous air monitoring, well water, vegetation, river algae, and river mud are given as a basis for comparing future conditions with those existing prior to operation of the plant. The extent of variation in the data due to environmental factors is pointed out. Corrections to data given in previous reports are given, and descriptions of sampling stations, sampling procedures, and analytical methods are included as appendices. (T.R.H.)

11260
LIVER RESPIRATION IN NORMAL IRRADIATED AND SYNKAVIT-TREATED RATS. ENDOGENOUS RESPIRATION IN PHOSPHATE BUFFER. H. K. Hanel, G. Hjort, and P. R. Purser (Radium Centre, Copenhagen). Acta Radiol. 49, 401-6(1958) May.

Whole body roentgen irradiation of rats with 450 r is shown to increase the endogenous respiration of liver slices. Pretreatment with synkavit results in a similar but earlier effect, which becomes irreversible after larger doses. (auth)

11261
RESPIRATOR PROBLEMS IN ATOMIC ENERGY PRACTICE. G. W. C. Tait and T. H. Byington (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Am. Ind. Hyg. Assoc. J. 19, 123-5(1958) Apr.

As a result of the NRX reactor accident of December 12, 1952, large crews were dependent upon respirators for protection during the dismantling and rebuilding of the damaged reactor. The efficiency of the respirators used for protection of the workmen is discussed. (C.H.)

11262
USE OF REMOVABLE LACQUERS FOR PROTECTION AGAINST RADIOACTIVE CONTAMINATION.
H. Dreiheller and E. H. Graul (Univ. of Marburg). Atompraxis 4, 177-8(1958). (In German)

Removable plastic-base varnish is an indispensable help for laboratory work with radioactive material. The chemical and physical permanence of the varnish makes it particularly valuable and time saving for such work. Through use of an easily applied, water-soluble undercoating the varnish can also be put on, and removed from, rough and porous surfaces. The undercoating can also be used as an isolation between two layers of varnish, thus forming several layers which can be removed one after the other (onionskin). This makes possible an effective wall protection for laboratories. Certain examples of application technique are given. (auth)

11263
OCCUPATIONAL RADIATION PROTECTION: AN ETHICAL AND TECHNICAL PROBLEM. S. Balke.

Atomwirtschaft 3, 189-91(1958) May. (In German)

The protection of the working man against ionizing radiations is not only a technical but also an ethical problem, because the anxiety of mankind would be greatly increased by thoughtlessness in this field. The principle to adapt safety measures to the greatest sources of danger will require considerable economic expense. All measures of occupational protection must be regarded as part of the manufacturing process and must be put on an equal footing with other technical and economical production factors. They must be separated from the whole volume of social measures which are intended to serve quite different objectives. (auth)

11264

POSSIBLE IMPROVEMENT IN MASKS AND PROTECTIVE FILTERS AGAINST RADIOACTIVE POWDERS. Pierre-Octave Robert. Compt. rend. 246, 2886-9(1958) May 19. (In French)

It is shown that even the best masks are not capable of assuring protection in a very contaminated area. However, by the use of three or more layers of the filters and a filter weight increase of 50%, the maximum permissible dose would not be attained in 100 8-hr days. The pressure drop with a mask of this type would be 6 mm. (J.S.R.)

11265

ELECTRONICS IN PROTECTION AGAINST NUCLEAR RADIATIONS. Jacques Labeyrie (CEA). Ind. Atom. 2, No. 5-6, 79-88(1958). (In French)

Radiation hazards and electronic means of detecting and measuring them are discussed in two categories: radiations from accelerators, reactors, and research sources, and radiations from fission product contamination of persons, objects, or environs. Dose tolerances are tabulated and discussed, and instruments for detection and measurement of x and gamma radiation, neutron flux measurement, hand monitoring, atmosphere monitoring, and radon determination are described. (T.R.H.)

11266

DEXTRAN LOCALIZATION AND RETENTION IN NORMAL AND X-RAY IRRADIATED RABBITS. Lawrence E. Detrick, Harvey C. Upham, Dorothy Highby, and Thomas J. Haley (Los Alamos Scientific Lab., N. Mex.). J. Am. Pharm. Assoc. Sci. Ed. 47, No. 2, 93-7(1958) Feb.

Intravenous saline or dextran had no influence upon the effects produced by 500 r acute whole body x irradiation in rabbits. The irradiation caused a post-irradiation shock-like syndrome in rabbits and minor histopathological changes in the liver. Neither saline nor dextran affected the fatal termination of the syndrome. In rabbits, 500 r x-irradiation was not a noxious stress of sufficient magnitude to impair metabolic or excretory functions of organs and alter dextran storage in tissues examined sixty days later. When examined sixty days post irradiation, there was no significant difference in tissue storage or distribution of dextran between irradiated and nonirradiated animals. The intensity of dextran storage within rabbit organs was directly proportional to dosage and inversely proportional to the time after injection in those organs examined prior to the sixty day sacrifice interval. Irradiation did not affect storage either qualitatively or quantitatively. (auth)

11267

RADIOACTIVE SUBSTANCES AND WATER: A DOCUMENTATION. Walther Kumpf, Bernd Dieterich, and Joachim Kumpf. Munich, R. Oldenbourg Verlag, 1956. 140p. (In German)

Abstracts of the papers presented at the Geneva Conference and the Cleveland Conference of 1955 on the subject of radioactive substances and water are presented. The abstracts are grouped under the following subjects: general problem of radioactive wastes; danger of radioactive materials and highest permissible concentration in water; management precautions for the protection of the population and the water supply; measurement of radioactivity in water; purification and elimination of contaminated water; radioactive content of surface waters; and radioactive fall-out. Bibliographies follow each section. (J.S.R.)

11268

A SURVEY OF RADIATION EXPOSURE IN PEDIATRIC PRACTICE. Mitchell R. Zavon and Peter J. Valaer (U. S. Public Health Service, Cincinnati). Pediatrics 20, 941-6(1957) Nov.

The work habits and equipment of 44 pediatricians who use fluoroscopes in office practice were studied to determine radiation exposure. Most of the pediatricians surveyed had exposures that were low by comparison with present maximal permissible limits. The low exposures were, however, not due to intrinsic protection nor necessarily to good technique, but to infrequent use of the equipment. Recommendations are included for increasing protection. (C.H.)

11269

RELATIONSHIP OF BORON NUTRITION TO RADIOSENSITIVITY OF SUNFLOWER PLANTS. John Skok (Argonne National Lab., Lemont, Ill.). Plant Physiol. 32, 648-58(1957) Nov.

Seven-day-old Mammoth Russian sunflower seedlings were grown in nutrient solutions with or without boron, for 2 to 5 days, after which they were x irradiated and again supplied with boron. Withholding boron for short intervals prior to x irradiation with doses that normally produce pronounced radiation symptoms, had a marked alleviating effect on the development of radiation injury. The absence of boron resulted in retardation of some phase of cellular activity and rendered the plants more radioresistant. This normally radiosensitive phase of cellular activity which may be rendered relatively radioresistant by withholding boron is, then, boron-dependent. An attempt was made to identify this growth phase by irradiating a series of germinating seedlings at different growth stages. It appeared to be the phase of cellular maturation rather than cell division, suggesting that boron is required for some process or processes concerned with cellular maturation or differentiation. The apparent effect of boron on sugar translocation appears to be related to the effect of boron on cellular activity rather than to a direct enhancement of diffusion through membranes through formation of a sugar-borate complex. (auth)

11270

MEDICAL–RADIOLOGICAL PROBLEM OF RADIATION PROTECTION. Hermann Holthusen. Strahlentherapie 106, 15-25(1958). (In German)

Starting from an historical survey of the oldest measures concerning the protection against rays in roentgenology, the different periods in the course of which the organisatory measures were introduced in order to guarantee an adequate radio-protection are discussed. These measures consist in the stipulation of maximum admissible doses, in the elaboration of regulations concerning the radio-protection, and in the creation of appropriate control organs to guarantee their being observed. Furthermore, the report deals with the experiences gathered in executing the tightened international recommendations on maximum admissible

doses. The total change of the population through rays originating from sources which serve civilization, especially through medical application of ionizing rays, is reviewed. Finally, the statistical inquiries started in Hamburg in order to obtain reliable figures on therapeutical radiations and the resulting charge of rays per head of the population are considered. (auth)

11271
SPECIFIC QUESTION OF RADIATION PROTECTION IN RESEARCH INSTITUTIONS AND TECHNICAL PLANTS. Robert G. Jaeger. Strahlentherapie 106, 26-43(1958). (In German)

After characteristical dates on the special situation of research laboratories on one side and technical plants on the other side in relation to radiation protection are discussed, some technical questions are dealt with that are especially related to the use of rays by these two groups. In this aspect also such technical work is to be included as is still somewhat marginal for today's considerations, as for instance the extraction and the dressing of uranium as well as the measures taken in relation to accidents that may occur with the usual routine work with radioactive material. The necessity of starting the building up of an ample organization for protection against radiation is then discussed. (auth)

11272
THE FUNCTIONS OF DOCTORS IN ATOMIC PLANTS. Emil Heinz Graul (Philipps-Universität, Marburg a. d. Lahn, Germany). Strahlentherapie 106, 44-57(1958). (In German)

The various diagnostic, prophylactic, and therapeutic tasks of the physician in nuclear plants are discussed and compared with those of health physics service. (auth)

11273
THE MEASUREMENT OF THE GONAD DOSE RECEIVED BY THE PATIENT IN X-RAY DIAGNOSIS. (PRELIMINARY REPORT). Hans Mohr (Allgemeinen Krankenhauses St. Georg, Hamburg). Strahlentherapie 106, 80-4(1958). (In German)

The results of the measurements are tabulated. Concluding, some possibilities of curtailment of the gonad doses are discussed. (auth)

11274
SOME STUDIES ON THE EVALUATION OF GUMMED-PAPER COLLECTORS USED IN DETERMINING RADIOACTIVE FALLOUT. Jan Rosinski (Illinois Inst. of Tech., Chicago). Trans. Am. Geophys. Union 38, 857-63(1957) Dec.

An evaluation was made of the gummed-paper collector used in determining radioactive fallout. Sampling under rainless conditions was examined quantitatively as a function of humidity, wind velocity, ultraviolet radiation, and storage time. It was found that sampling is a complicated function of wind velocity and humidity, with electrostatic effects as a dependent variable. Sampling during rain was found to be a function of the wettability of particulate matter, hydrophobic particles being readily deposited from raindrops. Some evidence is presented that the delayed radioactive fallout is hydrophilic or soluble in water or both. (auth)

Radiation Sickness

11275
CIRCULATION IN THE BLOOD OF TISSUE ANTIGENS PRODUCED BY RADIATION SICKNESS. P. V. Petrov and L. I. Ilyina. Bull. Exptl. Biol. Med. (USSR) (English Translation) 44, 917-23(1957) Aug.

Abnormal tissue antigens have been demonstrated as a product of irradiation of the organism. Proteins labelled with methonin-S^{35} have been obtained from the bone marrow, spleen, testes, and intestinal mucosa. Their passage via the blood stream to the liver has been demonstrated. Irradiation diminishes antigenic differences. As irradiation sickness progresses, these abnormal antigens must play an important role in the progress of the disease. Adsorption of the antigens against the normal tissues opens a tentative path into very interesting future research for possible treatment of irradiation sickness. (auth)

Radiography

11276 ORINS-20
Oak Ridge Inst. of Nuclear Studies, Inc., Tenn.
RADIOISOTOPE SCANNING. An Introduction to the Use of the Area Scan in Medical Diagnosis. Marshall Brucer. Jan. 1958. 175p. Contract [AT-40-1-GEN-33]. $1.00(GPO).

A text book on scanners and scanning and their applications and limitations is presented. The material is divided into chapters on: The Scanning Problem; The Machinery for Scanning; Factors of Resolution; Methods of Study and Calibration; Definition in Area Scanning; Simple Test Scans; Complex Scans of the Standard Mannikin; Artifacts in the Appearance of a Scan; Examples of Poor and Good Scans. (T.R.H.)

11277
RADIATION DOSE TO GONADS FROM DIAGNOSTIC X-RAY EXPOSURE. Thomas A. Lincoln and Edwin D. Gupton (Oak Ridge National Lab., Tenn.). J. Am. Med. Assoc. 166, 233-9(1958) Jan. 18.

The doses of x-ray received by employees of the Oak Ridge National Laboratory were investigated for the purpose of estimating the total exposure to ionizing radiation received both within and outside the medical facilities of the ORNL. A manikin was constructed to permit measurement of the radiation received by skin and gonads during examinations of the chest, knee, abdomen, pelvis, and vertebral column. The frequency of the various types of examination was also studied. The average total gonadal dose per year was 0.013 rads for males and 0.035 rads for females. Although only 5% of the total male examinations were of the abdominal area, they contributed 81% of the total male gonad dose. Minimizing the number of abdominal examinations is most important, particularly in children, but minimizing the gonad dose during each examination should not be overlooked. Three simple steps are emphasized: use a cone or diaphragm of minimum practicable size to reduce the dose to all areas outside the field of interest, use filtration at the source to reduce the amount of soft, scattered radiation, and use the highest kilovoltage and lowest milliamperage technique which is practicable. Personal diagnostic radiation exposure records as recommended by the National Academy of Sciences may possibly be kept by expanding the system of occupational exposure records now maintained in most industrial medical departments. (auth)

Radiotherapy

11278
A FEW NOTIONS INVOLVED IN THE CLINICAL USE OF RADIOISOTOPES. Gould A. Andrews (Oak Ridge

Inst. of Nuclear Studies, Tenn.). Ann. Internal Med. 47, No. 5, 922-38(1957) Nov.

Basic concepts in diagnostic and therapeutic applications of radioisotopes are reviewed. (C.H.)

11279

THE BASIS OF THERAPY WITH RADIOACTIVE ISOTOPES. Marshall Brucer (Oak Ridge Inst. of Nuclear Studies, Tenn.). Atomkern-Energie 3, 217-21(1958) June. (In German)

Radioisotopes are used today in widely dissimilar fields of medicine and in a widely varying manner. This chapter is an attempt to illustrate some basic principles of their use which are strongly related to the principles of radiation physics. The first part of the paper deals with the use of Co^{60}, Cs^{137}, and Eu^{155} for teletherapy machines and of Co^{60}, Eu^{152}, P^{32}, and Y^{90} for varying brachytherapy devices. The arising problems of radiation protection are also discussed. Following this, the use of isotopes in therapy by mechanical placement of the material will be described. This includes direct and intracavitary injection of Au^{198}, Y^{90}, and Lu^{177}. The following part shows the development of a new and promising type of therapy, called semimechanical placement. Here the isotope is not expected to remain at the place of injection but to be picked up by the lymphatic stream and be carried to the lymph nodes. Another variation is the intravenous injection of particulate matter which will be trapped in liver, spleen or bone marrow for internal irradiation. The final part is assigned to the metabolic location of isotopes, especially of I^{131}. The major problem is the dosage control. Emphasis is put on the recent developments of measuring devices, especially the scanning method and its correct evaluation for diagnostic purposes. (auth)

11280

RADIATION POISONING OF DOCTORS AND NURSING PERSONNEL IN GYNECOLOGICAL RADIATION THERAPY. Hans-Karl Leetz, Fritz Masch, and Hans Mohr (Allgemeinen Krankenhauses, St. Georg, Hamburg). Strahlentherapie 106, 70-9(1958). (In German)

Because Curietherapy in general, and the treatment of gynecological carcinomas in particular, represents a bottle-neck as to the observance of regulations for adequate protection of the personnel against irradiation burns, the actual conditions in a heavily frequented major hospital are described on the strength of personal experiences. The ray load of the personnel in typical, frequently recurring working processes, such as preparation and application, as well as during regular nursing at the sick-bed, is analyzed. Under present conditions it is difficult to keep within the admissible weekly maximum doses whenever radium work exceeds a certain amount. Additional protective measures of various kinds, among which periodical relevant schooling of the staff proved particularly effective, were unavoidable and shall also be continued in the future in order to obtain a further decrease in the actual individual doses. (auth)

11281

ON THE TREATMENT OF BRAIN TUMORS AND METASTASIZING TUMORS BY RADIOACTIVE GOLD. Hugo Ruf (Nervenklinik der Stadt und Univ. Frankfurt a. M.) and Werner Hellriégel (Röntgen-Inst. der Univ. Frankfurt a. M.). Strahlentherapie 106, 123-6(1958). (In German)

For postoperative irradiation of tumors of the brain, above all of glioblastomas, radiogold seeds are inserted in the tumorous tissue. In advanced metastasizing carcinomas of the prostata and the breast and other malignant tumors, the hypophysis was percutaneously put out of action. (auth)

Toxicology Studies

11282

THE EFFECT OF DEUTERIUM OXIDE ON SURVIVAL OF MICE WITH ASCITES TUMOR. Ann M. Hughes, Bert M. Tolbert, Karl Lonberg-Holm, and Melvin Calvin (Univ. of California, Berkeley). Biochim. Biophys. Acta 28, 58-61(1958).

The effect of deuterium oxide (D_2O) on the survival of mice inoculated with Ehrlich's mouse ascites tumor has been studied. Mice maintained on 25% and 30% D_2O drinking water showed an improved survival time of about 6 days, whereas 40% D_2O drinking water had no effect on survival time. The effect is interpreted in terms of inhibition of tumor cell division and systemic toxicity. (auth)

11283

PRODUCTION OF STERILITY IN MICE BY DEUTERIUM OXIDE. Ann M. Hughes and Melvin Calvin (Univ. of California, Berkeley). Science 127, 1445-6(1958) June 20.

Sterility was induced in both male and female mice following the substitution of D_2O for a part of the drinking water. Doses of 5 to 30% deuterium oxide were administered. C_{57} and Swiss mice were used and both strain and sex differences in response to D_2O were noted. No significant differences were noted in litter size or sex ratio from that of the controls. Several physiological mechanisms by which D_2O produces sterility in mice are suggested. (C.H.)

Tracer Applications

11284 LA-2207

Los Alamos Scientific Lab., N. Mex.

RETENTION AND EXCRETION OF RADIONUCLIDES OF THE ALKALI METALS BY FIVE MAMMALIAN SPECIES. Chester R. Richmond. Mar. 1958. 140p. Contract W-7405-eng-36. $2.75(OTS).

Large-volume liquid-scintillation counters were used to measure the biological half-time ($BT_{\frac{1}{2}}$), whole-body retention, and excretion of Na^{22}, K^{42}, Rb^{86}, Cs^{134}, and Cs^{137} in five species of animals. Mice, rats, monkeys, dogs, and men were given 0.1 to 1.0 μc amounts of the radionuclides by oral, intraperitoneal, or intravenous administration. Radioactivity in the excreta was measured at subsequent 24 hour intervals, and the whole-body retention was followed by in vivo radioassay, where possible, until the retained body burden fell to 1.0 to 0.1% of the administered dose. The logarithms of the retention and excretion levels were plotted as functions of time after administration, and standard first-order kinetics were applied to determine the $BT_{\frac{1}{2}}$ values and retention equations. The $BT_{\frac{1}{2}}$, as used in this report, is the time required for the whole-body activity to decrease by a factor of 2 owing to biological loss. Tissue distribution of the radionuclides at various times after administration was studied in rats to help interpret the retention data. Findings are discussed. (auth)

11285

THE EFFECTS OF ACUTE PROTEIN DEPLETION ON THE DISTRIBUTION OF RADIOIRON IN RAT TISSUES. W. F. Bethard, R. W. Wissler, J. S. Thompson, M. A. Schroeder, and M. J. Robson (Argonne Cancer Research

Hospital, Chicago and Argonne National Lab., Lemont, Ill.). Blood 8, No. 2, 146-55(1958) Feb.

The distribution of Fe^{59} in plasma, bone marrow, erythrocytes, liver, and spleen was determined at specified intervals after single intravenous injections of the radioisotope into normal and protein-deficient rats. In normal rats, injected radioiron followed the usual metabolic pathways; i.e., through bone marrow to erythrocytes, with small, consistent amounts to liver and spleen. In protein-deficient animals normal Fe^{59} time-concentration relationships were disrupted completely. Less iron was recovered from the tissues of protein-deficient rats than from normal animals. Storage iron in liver and spleen was not conjugated with polysaccharide, even though tissue protein was seriously depleted. (auth)

11286

KINETICS OF STRONTIUM METABOLISM IN MAN. Göran C. H. Bauer and Robert D. Ray (Univ. of Lund, Malmö, Sweden and Univ. of Washington Medical School, Seattle). J. Bone and Joint Surg. 40A, No. 1, 171-86 (1958) Jan.

Strontium metabolism was studied in five adult males by external counts over various body locations and counts made on serial samples of serum, urine, and stools for seven to fourteen days following the parenteral administration of trace amounts of strontium-85. With the use of a d-c analog computer, it was possible to simulate the blood-disappearance and excretory-appearance curves with a four-compartment model and two bleed-outs, one representing loss of isotope from the exchangeable strontium space due to new bone formation and one representing excretion. The rates involved in this model suggest that the four compartments represent serum, extravascular-extracellular fluid, intracellular fluid, and bone strontium. The latter represents about half the total exchangeable strontium space. (C.H.)

11287

QUALITATIVE AND QUANTITATIVE ASPECTS OF THE IODINE CHANGE STUDIED BY MEANS OF RADIOISOTOPES. A. Costa, F. Cottino, and G. M. Ferraris (Dell'Istituto per le malattie endocrine e del ricambio dell'Ospedale Mauriziano, Turin) and G. Cetini (Univ. of Turin). Minerva nucleare 2, 104-31(1958) Apr. (In Italian)

The most recent contributions of radioisotope techniques as regards the metabolism of iodine in human diseases were considered. Particular attention was given to the autoradiochromatographic and autoradiohistographic techniques and their results. 322 references. (auth)

11288

PRELIMINARY RESULTS OF THE USE OF I^{131} IN THE TOPOGRAPHIC STUDY OF SOME NEUROPSYCHIATRIC DISORDERS. R. Bozzi, D. De Maio, and A. Zubiani. Minerva nucleare 2, 155-6(1958) Apr. (In Italian)

The results are presented of researches on the thyroid function in certain neuropsychiatric disorders: phrenasthenia, chronic alcoholism, epilepsy, etc. These cases were studied both from the standpoint of absorption by the thyroid of the radioactive element and by means of cerebral gammagraphy. (auth)

11289

TRACER STUDIES OF FUNGICIDAL ACTION. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 71, Session 1. R. W. Greenlee, H. T. Kemp, R. S. Davidson, and M. M. Baldwin (Battelle Memorial Inst., Columbus, Ohio). New York, American Institute of Chemical Engineers, 1958. 29p.

An attempt was made to correlate the sorption uptake of compounds of equal inherent toxicity with differential fungicidal effects. Two homologous series of compounds containing toxic moieties provided pairs which seemed suitable for a radiotracer sorption study of this relationship. The pairs chosen were potassium dimethyldithiocarbamate and potassium di-n-propyldithiocarbamate and N-n-butyl-ethylenethiourea and N-n-propyl-ethylenethiourea. The former member of each pair was decidedly more fungicidal than the latter. Chemical studies were made to demonstrate the chemical similarity and to find convenient preparative methods for these compounds. Radiosyntheses involved the incorporation of sulfur-35 in each case. In the case of the dithiocarbamate salts, the innocuous di-n-propyl derivative was more strongly sorbed than the toxic dimethyl compound. Similarly, with the N-alkylethylenethioureas, the less fungicidal n-propyl derivative was more strongly sorbed than the n-butyl compound. A possible explanation of the lack of toxic effect by the apparently inactive compounds is that, in these cases, the exercise of inherent toxicity is prevented by preferential sorption on the fungus spore wall. (auth)

11290

CELLULAR PROLIFERATION IN THE MOUSE AS REVEALED BY AUTORADIOGRAPHY WITH TRITIATED THYMIDINE. W. L. Hughes, V. P. Bond, G. Brecher, E. P. Cronkite, R. B. Painter, H. Quastler, and F. G. Sherman (Brookhaven National Lab., Upton, N. Y., National Institutes of Health, Bethesda, Md., and Brown Univ., Providence). Proc. Natl. Acad. Sci. U. S. 44, 476-83(1958) May.

CHEMISTRY

Refer also to abstract 12098.

11291 AERE-C/R-2221

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

SOME FISSION PRODUCT PARTITION DATA FOR BUTEX (DIBUTYL CARBITOL). H. A. C. McKay, K. Alcock, and D. Scargill. 1958. Date of MS. June 16, 1953. Decl. with amendment Sept. 10, 1956. 6p. $0.32(BIS).

Declassified version of AERE-C/R-1212.

The partition of traces of Y and Ce between water and butex was determined in the presence of HNO_3, using Y^{91} and Ce^{144} tracers. The partition of Zr between water and butex in the presence of HNO_3, using Zr^{95} as a carrier-free tracer, has also been determined. (W.L.H.)

11292 AERE-T/M-93

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

AN ESTIMATE OF THE PARTICLE SIZE REQUIRED IN A SETTLED SLURRY FUEL ELEMENT. W. M. Lomer. 1958. Date of MS. Nov. 1953. Decl. Aug. 1957. 10p. $0.32(BIS).

It is estimated that fission products will diffuse out of solid particles of UPb_3 into liquid lead at a rate equal to the rate of production when the concentration at the center of the particle corresponds to 2% burnup if the particle has a radius of about ten microns. Purely diffusive flow through the liquid in the interstices of the

slurry limits the depth of slurry to a few centimeters. Problems of bubbling and flotation of the slurry are not treated in any detail, but are shown to be extremely important in assessing the practicability of the scheme. (auth)

11293 AFOSR-TN-58-291

Ohio State Univ. Research Foundation, Columbus.

RARE EARTH OXIDES. I. THE VAPORIZATION OF NEODYMIUM SESQUIOXIDE, Nd_2O_3. DISSOCIATION ENERGY OF NdO AND TaO. Technical Note No. 1. Harold Goldstein, Patrick N. Walsh, and David White. Jan. 1958. 19p. Project No. 77520. Contract AF18(600)-1545. (AD-154196).

The vaporization of Nd_2O_3 has been studied by the Knudsen effusion method in the temperature range 2040 to 2450°K. Both tungsten and tantalum effusion cells were used in the experiments. From the tungsten refractory, the vaporization of Nd_2O_3 proceeds predominantly by dissociation to NdO(g) and O(g), whereas in the case of the tantalum refractory the Nd_2O_3 reacts with the cell, yielding primarily the gaseous species NdO and TaO. From the vapor pressure determinations, with the aid of free energy functions, ΔH_0^0's for the following reactions were established:

Tungsten Knudsen cell

$$Nd_2O_3(s) \rightarrow 2NdO(g) + O(g)$$

$$\Delta H_0^0 = 423.3 \text{ kcal}$$

Tantalum Knudsen cell

$$Nd_2O_3(s) + Ta(s) \rightarrow 2NdO(g) + TaO(g)$$

$$\Delta H_0^0 = 393.9 \text{ kcal}$$

and the dissociation energies for TaO and NdO calculated to be $D_0^0(NdO) = 7.34 \pm 0.2$ e.v. $D_0^0(TaO) = 9.36 \pm 0.2$ e.v. The dissociation energy of TaO is not in agreement with the recent value reported from mass spectrometric studies. Some reasons for this apparent discrepancy are given. (auth)

11294 IDO-14442

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

THE SOLUBILITY OF ZIRCONIUM TETRAFLUORIDE IN NITRIC ACID FROM 0 TO 80°C. A. G. Chapman and C. M. Slansky. Apr. 30, 1958. 17p. Contract AT(10-1)-205. $0.75(OTS).

The solubility of zirconium tetrafluoride in concentrations of nitric acid from 1 to 16M and at temperatures from 0 to 80°C was determined. At least three solid species of zirconium fluoride as determined by x-ray diffraction and chemical analysis were observed to be in equilibrium with nitric acid through these ranges of concentration and temperature: zirconium tetrafluoride monohydrate, $ZrF_4 \cdot H_2O$ or $ZrOF_2 \cdot 2HF$, is the stable solid phase in equilibrium with nitric acid greater than about 8 molar through the entire measured temperature range and in nitric acid concentrations above 4 molar at temperatures above 50 to 60°C; zirconium tetrafluoride trihydrate, $ZrF_4 \cdot 3H_2O$, at acid concentrations below about 6M and temperatures below about 50 to 60°C; and a solid having unidentified x-ray-diffraction pattern and chemical composition of approximately 3 moles of fluoride to 1 mole of zirconium in nitric acid of less than 4M and at temperatures above about 50 to 60°C. The solubility of zirconium tetrafluoride in nitric acid expressed as grams ZrO_2 per liter ranges from about 0.5 grams per liter at 0°C in 16M acid to approximately 215 g/l at 80°C in 1M acid. (auth)

11295 ISC-929

Ames Lab., Ames, Iowa.

SOLUBILITY OF WATER IN MOLTEN ALKALI CHLORIDES. William J. Burkhard and J. D. Corbett. July 1957. 50p. Contract W-7405-eng-82. $1.50(OTS).

The solubility of water in molten mixtures of lithium chloride and potassium chloride containing 50.0, 53.0, 60.0, and 68.6 mole % lithium chloride was determined at 480 and 390°C in the pressure range zero to 26 mm. Melts were dried by alternate hydrogen chloride flushing and evacuation, and the solubility was determined by measuring the quantity of water vapor absorbed by the melt. The solubility versus pressure curves follow Henry's law from zero to 18 mm pressure at 480° and from zero to 10 mm at 390°. The reciprocal Henry's law constants, K, are 14, 11.8, 11.3, and 10.8 micromoles water per mole lithium chloride per mm for the 50, 53, 60, and 68.6 mole % mixtures at 480°, and are 30.0 and 30.5 for the 50 and 60 mole % mixtures at 390°. Heats of solution calculated from smoothed data are −8.4 kcal per mole for the 50 mole % mixture and −11.0 kcal per mole for the 60 mole % mixture. The 480° solubility curve exhibits a definite upward break beyond 18 mm pressure due to hydrolysis of the lithium chloride at the higher water concentrations. The 390° curve shows no break below 26 mm, but does show a slight upward deviation above 10 mm pressure. The unusual tenacity with which water is retained by the melt and the hydrolysis of the melt under non-equilibrium conditions are discussed in an Appendix. (auth)

11296 KY-240

Union Carbide Nuclear Co. Paducah Plant, Ky.

FLUIDIZATION IN TAPERED BEDS. W. R. Rossmassler and R. L. Harris. Feb. 14, 1958. 12p. Contract W-7405-eng-26. $0.50(OTS).

The concept of a tapered fluidized bed is explored briefly. Data are given showing that in bench-scale apparatus a tapered bed gives better fluidization with some materials that are difficult to fluidize in a conventional cylindrical bed. (auth)

11297 WAPD-PWR-CP-2704

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

PWR CHEMISTRY PROGRAM FOR JANUARY 1, TO JULY 1, 1957. 29p. $6.30(ph OTS); $3.00(mf OTS).

The chemistry requirements in PWR are directed toward satisfying three basic requirements: The assurance of the structural integrity and operational status of the plant including its mechanical and heat transfer components. Provision for continuous operation and accessibility for maintenance in a radioactive plant. Control and safe disposal of radioactive wastes are made in compliance with established standards. (auth)

11298 AEC-tr-3254

THE DIFFUSION OF HYDROGEN AND DEUTERIUM IN PALLADIUM. PART II. W. Jost and A. Widmann. Translated from Z. physik. Chem. (Leipzig) 45B, 285-96(1940). 13p.

Procedures for study are discussed, and the basic difficulties attendant upon precision measurements are presented. Previous experiments and those reported here give the ratio of the diffusion coefficients of H and D in Pd as $< \sqrt{2}$. This result is analyzed in connection with the fact that a difference between zero-level energies of H and D in the palladium lattice must certainly exist, and should form a contribution to the activation energy of transposition, thereby elevating the above ratio. (auth)

11299 AEC-tr-3280
DIFFUSION OF RARE GAS ATOMS THAT ARE FORMED BY NUCLEAR REACTION IN SOLIDS. K. E. Zimen. Translated for Westinghouse Electric Corp. Atomic Power Div. from Trans. Chalmers Univ. Technol., Gothenburg, No. 175, (1956). 6p.

Methods are presented for the measurement of the permeation of rare gases through solids. (W.L.H.)

11300 AEC-tr-3284
DETERMINATION OF THE COEFFICIENTS OF DIFFUSION OF SILVER AND OF IODINE IN THE THREE MODIFICATIONS OF SILVER IODIDE BY THE METHOD OF HETEROGENEOUS ISOTOPIC EXCHANGES. P. Jordan and M. Pochon. Translated for Westinghouse Electric Corp. Atomic Power Div. from Helv. Phys. Acta 30, 33-48(1957). 16p.

The kinetics of heterogeneous isotopic exchange among the three allotropic modifications of silver iodide and its ions in aqueous solution have been studied between 20 and 200°C. The solid was made up of calibrated particles of mean diameters from 3 to 300 μ or by compressed tablets. (auth)

11301 AEC-tr-3285
THE HEAT CAPACITY OF LAYER LATTICES AT LOW TEMPERATURES. E. S. Itskevich and P. G. Strelkov. Translated by Lydia Venters (Argonne National Lab.) from Doklady Akad. Nauk S.S.S.R. 106, 805-6(1956). 4p.

The temperature dependence of the heat capacity of cadmium iodide, cadmium bromide, and cadmium chloride and the crystal lattices of these compounds which are layer-like were investigated from 11 to 60°K. The results of this study are compared to the results obtained by other workers, and the causes of some deviations of values, thought to be differences in reagent preparation, are discussed. (J.R.D.)

11302
THE PREPARATION OF THE ADDITION COMPOUNDS OF ANHYDROUS SCANDIUM CHLORIDE AND SCANDIUM BROMIDE WITH ALCOHOLS. F. Petru, B. Hajek, and F. Jošt (Inst. of Chemical Technology, Prague). Croat. Chem. Acta 29, 457-60(1957). (In German)

It is shown that anhydrous scandium chloride and scandium bromide give with various alcohols (ROH) well-defined addition compounds of composition $ScX_3 \cdot n$ ROH where n is, with some exception, an integer not greater than 5. The preparation of the highest addition compounds was performed by the action of the alcohol vapors on the anhydrous scandium halide; the lower addition compounds were obtained by the stepwise decomposition. (tr-auth)

Aerosols

11303
A PARTICLE-SIZING METHOD FOR AEROSOLS AND FINE POWDERS. Robert L. Dimmick, Melvin T. Hatch, and James Ng (Univ. of California, Berkeley). Arch. Ind. Health 18, 23-9(1958) July.

Powders were dispersed as aerosols in cubic meter test tanks under the condition of stirred settling. A photomultiplier tube, monitoring the amount of light scattered at right angles by the particles as they passed through a Tyndall beam, provided a measure of the fall-out of the aerosol as it decayed with time. A plot of the light-scatter decay was divided into exponential portions by a slope-analysis method. The half-lives of the slopes were related to the particle size by a nomograph, and the values at zero time were weighted by the respective sizes to yield an estimate of the mass per cent of each size range. By plotting the cumulative mass percentages on probability paper an estimate of the apparent Stokes median diameter and the approximate distribution was obtained. (auth)

11304
A LARGE VOLUME ELECTROSTATIC AIR SAMPLER. Sidney C. Stern, David R. Steele, and Orvil E. A. Bolduan (Chemical Corps, Fort Detrick, Md.). Arch. Ind. Health 18, 30-3(1958) July.

A large-volume air sampler consisting of an electrostatic precipitation chamber, a wet-collection system for removing material, a high-voltage power supply, and an air mover is described. (auth)

Analytical Procedures

11305 AERE-C/R-2494
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE PHOTOMETRIC TITRATION OF BISMUTH WITH EDTA AND ITS APPLICATION TO THE DETERMINATION OF ZIRCONIUM. G. W. C. Milner and A. Bacon. Feb. 1958. 18p. $0.63(BIS).

The photometric method of end point detection has been applied to the direct titration of bismuth with EDTA using the iodide end point. The titration of miHigram amounts of bismuth can be carried out in solutions in the pH range from 1.0 to 5.0 by suitable selection of the iodide concentration. Chloride interferes by causing turbidities in solution, and fluoride considerably decreases the sensitivity by competing with the iodide for bismuth. Interference by sulfate, nitrate, and perchlorate is small, but tartrate and oxalate seriously interfere. In the application of this titration to the direct determination of the bismuth content of thorium base binary alloys, it proved possible to determine this constituent to better than 1% in alloys containing down to 2.5% of bismuth by using competitive complexation of thorium with sulfate ions. This titration has also been employed for the back-titration of excess EDTA in an indirect method for the determination of milligram amounts of zirconium. The method is applicable directly to fluoride-containing solutions, adjusted to pH 3, provided that beryllium ions are included to preferentially complex fluoride ions. It can be applied after the separation of zirconium as its insoluble barium fluozirconate and solution of this precipitate in a mixture of boric and nitric acids. (auth)

11306 HASL-33
New York Operations Office. Health and Safety Lab., AEC.
A PROCEDURE FOR THE ACID EXTRACTION AND ANALYSIS OF STRONTIUM 90 IN SOIL. Gerald H. Hamada and Edward P. Hardy, Jr.; WITH A RECOMMENDED METHOD FOR SOIL SAMPLING. Lyle T. Alexander. Apr. 7, 1958. 32p. $6.30(ph OTS); $3.00 (mf OTS).

A procedure is described for the acid extraction and analysis of strontium-90 in soil. The methods of collection, sub-sampling, extraction, separation, and counting are discussed, and the reproducibility and reliability of the analytical method is evaluated. (auth)

11307 IDO-14436
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
AMPEROMETRIC DETERMINATION OF TIN WITH

CUPFERRON. Stanley S. Yamamura, James E. Rein, and Glenn L. Booman. Apr. 8, 1958. 16p. Contract AT(10-1)-205. $3.30(ph OTS); $2.40(mf OTS).

Distillation of tin tetrabromide followed by an amperometric titration with cupferron is specific for the determination of tin(IV). Because large amounts of bromide and chloride interfere with the amperometric titration, the tin in the distillate is precipitated with ammonia using an aluminum hydroxide carrier. The precipitate is dissolved in sulfuric acid, adjusted to 3M ammonium sulfate and titrated with cupferron amperometrically at −0.84 volts vs. silver-silver chloride, saturated potassium chloride electrode. Ten fold and greater mole ratios of such elements as copper, iron, molybdenum, niobium, titanium, tungsten, uranium, vanadium, and zirconium give no bias. As much as a 100 to 1 mole ratio of zirconium can be tolerated making the method especially attractive for determining tin in zirconium matrix alloys such as zircaloy. For 0.09 millimoles of tin determined, the coefficient of variation is 0.45%. (auth)

11308 IDO-16442

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

RADIOMETRIC DETERMINATION OF KRYPTON-85. R. B. Regier. June 11, 1958. 13p. Contract AT(10-1)-205. $3.30(ph OTS); $2.40(mf OTS).

Apparatus and procedure for the determination of krypton-85 in gas samples are described. With only a single dilution, samples ranging in specific activity from about 1×10^{-3} μc/ml to 10 mc/ml were analyzed. The method of determining the absolute disintegration rate of krypton-85 is outlined. In routine use, the precision of the procedure is 7.1% at the 95% level of confidence. An estimate of the accuracy of the method was obtained by comparing the analyses of high activity samples with those obtained with a mass spectrometer. In the comparison of eleven such samples, the average of the radiometric to mass ratios was 1.01 ± 0.105 at the 95% confidence level. (auth)

11309 IGO-AM/W-112

United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.

THE DETERMINATION OF TRITIUM IN URINE. Feb. 1958. 6p.

Acetylene containing tritium generated by the action of the urine upon calcium carbide is passed through an ionization chamber, and the resulting ion current gives a measure of the tritium content. (auth)

11310 KAPL-M-VFC-3

Knolls Atomic Power Lab., Schenectady, N. Y.

RESIDUAL VPI 220 IN REACTOR STEAM GENERATORS. V. F. Consalvo and E. L. Shirley. June 19, 1958. 8p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

An empirical permanganate titration technique has been adapted to determine VPI "220" (di-isopropyl ammonium nitrite). Nitrites react in warm sulfuric acid solution with permanganate to oxidize nitrites to nitrates. Ammonia nitrogen in VPI "220" has also been determined by Kjeldahl distillation while the nitrite-nitrogen has been determined colorimetrically by the phenol disulfonic acid method after peroxide oxidation to nitrate. (auth)

11311 NP-6780

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

INDIREKTE METHODEN IN DER FLAMMENANALYSE. TEIL I. (Indirect Methods in Flame Analysis. Part I.) Report No. 20/VIII. J. Malinowski. Apr. 1958. 8p.

The effect of the ions SO_4^{2-}, PO_4^{3-}, Zr^{4+}, MoO_4^{2-}, WO_4^{2-}, VO_3^-, Be^{2+}, and AsO_4^{3-} on Ca or Sr emission was investigated using the Zeiss Model III flame photometer with an acetylene–air flame. It was established that, with the exception of Be, emission suppression was caused by the formation of the following heavy excitable compounds: $CaSO_4$, $Ca_3(PO_4)_2$, $CaMoO_4$, $CaWO_4$, $Ca_2V_2O_7$, $Ca_3(AsO_4)_2$, $SrWO_4$, Sr_2ZrO_4, and $Sr_2V_2O_7$. The possibility of applying these excitations to the quantitative determination of the excited ions was discussed. (tr-auth)

11312 RFP-53

Dow Chemical Co. Rocky Flats Plant, Denver.

SPECTROPHOTOMETRIC DETERMINATION OF ALUMINUM IN PLUTONIUM–ALUMINUM ALLOYS. J. M. Cleveland, Jr., and P. D. Nance. Nov. 3, 1955. Decl. June 23, 1958. 27p. Contract AT(29-1)-1106. $4.80(ph OTS); $2.70(mf OTS).

The method described involves the spectrophotometric determination of aluminum in plutonium-aluminum alloys following the separation of the excess plutonium and small amounts of iron from the aluminum by extraction of the cupferrate into chloroform. The aluminum concentration is determined on a Beckman Model DU spectrophotometer by measuring the optical density of the aluminum 8-hydroxyquinolate in chloroform at 385 millimicrons (mμ). A correction is made for the small amount of plutonium which carries through the cupferron extraction and forms plutonium 8-hydroxyquinolate along with aluminum. This is done by reading the optical density at 500 mμ and 650 mμ and using these values to correct the 385 mμ optical density reading. (auth)

11313 AEC-tr-3219

THE APPLICATION OF THE ALUMINUM INDICATOR ELECTRODE TO THE DETERMINATION OF ALUMINUM BY THE FLUORIDE METHOD. E. N. Ovsepyan and V. M. Tarayan. Translated for Los Alamos Scientific Lab. from Nauch. Trudy Gosudarst. Univ. im. V. M. Molotova, Erivan (Armenia) 53, 85-94(1956). 9p.

The indicator properties of the aluminum electrode result from its sensitivity toward fluoride ions, which dissolve the protective oxide layer on the surface of the electrode, as the result of which the value of the potential becomes more negative. The aluminum electrode may be used in the fluoride method for the determination of aluminum in the pH range 3 to 7, and if used according to the Chirkov method it is necessary to saturate the test solution with sodium chloride. (J.R.D.)

11314

PROTON MAGNETIC RESONANCE OF HUMAN MILK. Erik Odeblad and Björn Westin (Karolinska Inst. and Nobel Inst. of Physics, Stockholm). Acta Radiol. 49, 389-92(1958) May.

Methods are described for determining the proton magnetic resonance spectra and proton magnetic spin-lattice relaxation time of human milk at various periods after childbirth. (C.H.)

11315

QUANTITATIVE SPECTROGRAPHIC DETERMINATION OF ZIRCONIUM IN MINERALS. M. Roca Adell, F. Alvarez González, and R. Fernandez Cellini (Junta de Energia Nuclear, Madrid). Anales real soc. espan. fís. y quím. (Madrid), Ser. B 54, 273-7(1958) Apr. (In Spanish)

A spectrographic method for the semiquantitative estimation of zirconium in minerals and rocks in the

concentration range 0.02 to 100% of ZrO_2 is described. The excitation is carried out by means of a d-c 10-amp arc. Cobalt is used as carrier for low concentrations and copper for high concentrations using germanium dioxide as buffer and diluting agent. The results have been found succesful and in agreement with the results obtained by chemical methods. (auth)

11316

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS OF MINERALS AND OTHER PRODUCTS OF NUCLEAR INTEREST. F. Alvarez González, M. Roca Adell, and R. Fernández Cellini (Junta de Energia Nuclear, Madrid). Anales real soc. españ. fís. y quím. (Madrid) Ser. B 54, 278-84(1958) Apr. (In Spanish)

A spectrographic method for the semiquantitative estimation of 43 elements in minerals and other materials used in nuclear chemistry is described. The interval of concentration of the elements is 0.001 to 20%. The finely ground samples are directly excited or diluted with ammonium sulfate in a d-c arc of 5 amp for most of the elements and 10 amp for the low volatility elements. The percentage of each element is deduced by means of visual comparison with a control plate. The described technique is used in this laboratory as a routine method. (auth)

11317

ON THE SIMULTANEOUS POTENTIOMETRIC DETERMINATION OF MOLYBDENUM AND TUNGSTEN IN ALLOY STEELS. Ramón Suárez Acosta. Anales real soc. españ. fís y quím. (Madrid) Ser. B 54, 285-90 (1958) Apr. (In Spanish)

A new method for the simultaneous potentiometric determination of molybdenum and tungsten in alloy steel is presented. It consists in the reduction of the primary solution with metallic zinc and chromous salts and the reoxidation with a standard solution of potassium dichromate. It is recommended that the oxidizing solution be standardized using a steel of known molybdenum and tungsten content. The results obtained for molybdenum when it is present in a small amount with a large concentration of tungsten are discussed. The acidity necessary for the procedure is given. (J.S.R.)

11318

CHEMICAL ANALYSIS BY NEUTRON REACTIONS. U. Schindewolf (Univ. of Michigan, Ann Arbor). Angew. Chem. 70, No. 7, 181-7(1958). (In German)

The assumptions and limitations of neutron activation analysis are explained. If a substance contains isotopes with sufficiently high effective cross sections for thermal neutrons and if the half lives of the ensuing products are long enough, very small traces of an element can be detected either by measurement of the decay radiation or by determination of the decay products. Often chemical separation is not essential to the analysis. A table shows to how many isotopes the neutron activation method may be applied. 134 references. (tr-auth)

11319

SEMI-QUANTITATIVE DETERMINATION OF VANADIUM IN SOILS BY RISING PAPER CHROMATOGRAPHY. Henri Agrinier. Compt. rend. 246, 2761-3(1958) May 12. (In French)

The vanadium is separated by a solvent composed of ammonia and oxygenated water and then detected by 8-hydroxyquinoline. This method allows the determination of vanadium in soils with a sensitivity of the order of a millionth. (tr-auth)

11320

POLAROGRAPHIC STUDY OF THE ELECTRODE REDUCTION OF NIOBIUM AND TITANIUM IN SULFURIC ACID SOLUTIONS. E. I. Krylov and V. S. Kolevatova (S. M. Kirov Ural Polytechnical Inst.). J. Anal. Chem. U.S.S.R. (English Translation) 11, 147-51(1956) Mar.-Apr.

This paper was previously abstracted from the original language and appears in NSA, Vol. 10, as abstract No. 6556.

11321

DETECTION OF TRACES OF NICKEL BY MEANS OF PRECIPITATION CHROMATOGRAPHY. V. V. Olshanova (Lvov Polytechnical Inst.). J. Anal. Chem. U.S.S.R. (English Translation) 11, 173-8(1956) Mar.-Apr.

It is shown that small amounts (traces) of nickel may be determined in the presence of large amounts of cobalt, iron, and copper. It was established that the sensitivity of the Chugaev reaction for nickel decreases on decreasing the ratio Ni: Co(Fe, Cu). Thus, in solutions of nickel salts, the limit of identification is equal to 0.075 μg Ni^{2+} in a drop, for ratios of Ni : Co = 1 : 50 to 0.125 μg, while for a ratio of Ni: Co = 1 : 5000 it is only 0.5 μg of dimethylglyoxime as the absorbent. SO_4^{2-}, NO_3^-, and Cl^{2-} have practically no effect on reaction sensitivity. The best absorbents found from those tested were shown to be dimethylglyoxime treated with ammonia and a mixture of 10% dimethylglyoxime and 90% glass powder. The absorbent composed of dimethylglyoxime and special aluminum oxide for chromatography did not ensure separation of the tested pairs of ions. It was established that complex formation with ammonia and tartrate, respectively, has a positive effect on the separation of $Ni^{2+}-Co^{2+}$, $Ni^{2+}-Fe^{3+}$, and $Ni^{2+}-Cu^{2+}$. A method has been worked out for detecting traces of nickel in cobalt salts without having to resort to potassium cyanide, and a simple procedure is suggested for testing the specification of cobalt preparations with respect to nickel. (auth)

11322

NEW REAGENTS FOR THE COLORIMETRIC DETERMINATION OF BERYLLIUM—BERILLON I AND II. A. M. Lukin and G. B. Zavarikhina (All Union Scientific Research Inst. for Chemical Reagents, Moscow). J. Anal. Chem. U.S.S.R. (English Translation) 11, 409-16 (1956) July-Aug.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 123.

11323

COLORIMETRIC DETERMINATION OF BERYLLIUM BY MEANS OF A NEW REAGENT—BERILLON II. G. G. Karanovich (All-Union Scientific Research Inst. for Chemical Reagents, Moscow). J. Anal. Chem. U.S.S.R. (English Translation) 11, 417-21(1956) July-Aug.

An azo compound obtained by combining chromotropic acid with diazotized H-acid forms with beryllium a blue colored compound which is stable for 18 hours. An aqueous solution of this reagent is more stable than an aqueous solution of quinalizarin. The reagent has a similar sensitivity to quinalizarin (0.2 γ Be in 5 ml of solution). Conditions have been worked out for determination of beryllium in the presence of Fe^{3+}, Co, Ni, Cu, Al, Mg, and Ca. (auth)

11324

THE EFFECT OF IRON ON THE COLORIMETRIC DETERMINATION OF CERIUM. R. K. Korabelnik (Moscow Steel Inst.). J. Anal. Chem. U.S.S.R. (English Translation) 11, 439-42(1956) July-Aug.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 6515.

11325

DETECTION OF BERYLLIUM IONS. V. K. Zolotukhin (I. Franko Lvov State Univ.). J. Anal. Chem. U.S.S.R. (English Translation) 11, 541-2(1956) July–Aug.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 125.

11326

COLORIMETRIC DETERMINATION OF NIOBIUM AND TANTALUM IN ORES. F. V. Zaikovskii. J. Anal. Chem. U.S.S.R. (English Translation) 11, 591-7(1956) Sept.-Oct.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 1833.

11327

SPECTROCHEMICAL DETERMINATION OF BORON IN GRAPHITE. E. Golling (Siemens-Schuckertwerke AG., Erlangen). Nukleonik 1, 21-2(1958) Apr. (In German)

A spectral analytical procedure combined with an enrichment method is described for the quantitative determination of boron in graphite to 2×10^{-6}% with an error of 2 ± 1. The qualitative detection range is $\sim 10^{-7}$%. (tr-auth)

11328

NATURAL RADIOACTIVITY IN WATER. Hans Kiefer and Rupprecht Maushart (Kernreaktor Bau- and Betriobs-GmbH., Karlsruhe, Germany). Nukleonik 1, 22-7(1958) Apr.

In different waters the constituents of the individual components of the natural radioactivity were investigated. The most successful measuring methods were the chemical precipitation methods. Special emphasis was placed on the variation of the radon content of surface waters with water depth and underground water, on the deviations of the equilibrium state between radon and its decay products in water passed through piping and filters, and on the ratio of the natural to the artificial activity in water. (tr-auth)

Atomic Weights and Periodic Systems

11329

THE USE OF ^{12}C AS THE BASIS FOR A UNIFIED SCALE OF NUCLIDIC MASSES AND ATOMIC WEIGHTS IS PROPOSED. T. P. Kohman, J. H. E. Mattauch, and A. H. Wapstra. Science 127, 1431-2(1958) June 20.

A proposal to define the atomic mass unit as exactly $^1/_{12}$ of the mass of C^{12} is made and evaluated with respect to present scales and the effect of the change on the work of physicists and chemists. (T.R.H.)

Crystallography and Crystal Structure

11330 CF-58-1-26

Oak Ridge National Lab., Tenn.

THE CRYSTAL STRUCTURE OF Rb_3UF_7. L. A. Harris. Jan. 6, 1958. 3p. Contract [W-7405-eng-26]. $1.80 (ph OTS); $1.80 (mf OTS).

The compound whose chemical composition is Rb_3UF_7 was observed to be an optically isotropic single-phase material. The phase gave x-ray powder spectrometer data which were found to index well on the basis of a face-centered cubic unit cell. The cube edge was calculated to be 9.58 ± 0.03 A, and the calculated density assuming four molecules per unit cell is 4.78 gms/cm^3. (auth)

11331

ELECTRON DIFFRACTION STUDY OF THE BERYLLIUM HALIDE MOLECULAR STRUCTURES. P. A. Akishin, V. P. Spiridonov, and G. A Sobolev (Lomonosov, Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 118, 1134-7(1958) Feb. 21. (In Russian)

Electronograms of prepared specimens of BeF_2, $BeCl_2$, $BeBr_2$, and BeI_2 were taken on photofilms with 2 to 3 sec. exposure (8 to 10 electronogram series) to electron waves from 0.0403 to 0.0627 A. The electronograms showed higher intensity distributions for the even (2, 4, 6, 8, and 10) maximums than for the odd (3, 5, 7, and 9) maximums. With the increase of the angle of scattering the intensity curves for the even and correspondingly for the odd fall evenly. The relative intensity of odd maximums increase in transition from beryllium fluoride to iodide, the minimum curves preceding the parity maximums are deep while the ones preceding the odd maximums are shallow. Decodings were made using the radial distribution method and the method of approximations. The results of both methods produced similar configurations (of linear structure) and geometrical parameters for the paired beryllium halides. (R.V.J.)

Deuterium and Deuterium Compounds

11332 NPG-7(AECL)

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

A REVIEW OF SOME OF THE PHYSICAL PROPERTIES OF HEAVY WATER. W. E. Cooper. Jan. 1955. Supplement: A REVIEW OF SOME OF THE PROPERTIES OF HEAVY WATER. July 28, 1955. 14p.

The density, saturation pressure, viscosity, and specific heat of light and heavy water are tabulated from 10 to about 375°C, and the information is also reproduced in curve form. The data are considered accurate enough for use in reactor design calculations for temperatures up to 300°C. (J.R.D.)

11333

INVERSION OF SUCROSE IN H_2O AND D_2O. Jacques Nicolle and Feiga Weisbuch. Compt. rend. 246, 3164-7 (1958) June 2. (In French)

The effects of heavy water on the inversion of sucrose were investigated. The measurements were made at a temperature of 18°C using the Hg 5461 ray, and 99% heavy water. The reaction constant K was obtained for the inversion using HCl and the invertase B.D.H. as catalysts. For the invertase the ratio K_{H_2O}/K_{D_2O} is R = 1.54. With an HCl catalyst R = 0.65. No inversion was obtained using ultraviolet light as catalyst. The results show that the presence of D_2O produces an acceleration of the inversion reaction. Ultraviolet radiation, with the presence of HCl, also causes a more rapid inversion. (J.S.R.)

11334

REACTION BETWEEN DEUTERIUM AND METHYL RADICALS OBTAINED ACCORDING TO POLONYI METHOD. O. A. Ivanov, N. V. Fok, and V. V. Voevodskii (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 118, 1142-5(1958) Feb. 21. (In Russian)

Reactions between D_2 and methyl radicals obtained from the reaction $CH_3I + Na = CH_3 + NaI$ were studied. The scheme of the installation is shown. The spectroscopic analysis revealed the content of the variously deuterized methanes but the absolute methane quantity

was not determined. The experiment used electrolytically obtained D_2O purified from admixtures, refined CH_3I, and chemically pure sodium. It was revealed that the content of deuterium in the formed methanes varies considerably during the precipitation on the surface of metallic sodium vessels, and that the relation of methane content to the temperature depends on the type of sodium surface. At room temperature the content of deeply deuterized methanes (CD_4, CD_3, and CH_2D_2) in the sodium mirror coated vessels is 5 to 8 times higher than in pure quartz; with the increase of temperature the content of deuterized methane drops. In the case of sodium drops, the surface reaction is negligible, however, the methane from the radicals CH_3, formed in the volume, contain more deuterium than in the case of the sodium mirror. The maximum deuterization is at 70 to 80°; at higher temperature the CH_4 and CH_3D prevail. The light methane CH_4 does not exchange with the D_2 in the presence of the sodium mirrors nor the drops. (R.V.J.)

11335

THE CATALYTIC ACTIVITY OF GERMANIUM IN RELATION TO THE ISOTOPIC EXCHANGE REACTION BETWEEN HYDROGEN AND DEUTERIUM. G. K. Boreskov and V. L. Kuchaev (Karpov Physico-Chemical Research Inst.). Doklady Akad. Nauk S.S.S.R. 119, 302-4(1958) Mar. 11. (In Russian)

Comparisons were made of the specific catalytic activities of germanium and transition metals with incomplete d-zones in the isotopic exchange between hydrogen and deuterium. Simultaneously, investigations were made of the adsorption of hydrogen. It was revealed that hydrogen adsorption on germanium occurs with molecular dissociation. The adsorption activation energy equals 14.6 kcal/mole; the adsorption heat is 23.5 kcal/mole. It was assumed that the hydrogen atoms are bound to the germanium surface by co-valent forces and that their mobility along the surface is considerably slower than in adsorption on the other metals. (R.V.J.)

11336

THE SIGNIFICANCE OF THE PRODUCT AND SUM RULES TO ISOTOPE FRACTIONATION PROCESSES. Jacob Bigeleisen (Brookhaven National Lab., Upton, N. Y.). Proc. of the Intern. Symposium on Isotope Separation 121-57(1958).

The product rule, when combined with the usual partition function of a molecule, leads to the well known expression for the difference in free energies of isotopic molecules. From the latter the separation factors, which are significant in determining size, holdup, reflux, and equilibrium times of isotope separation plants by chemical exchange and distillation, are calculated. Separation factors and maximum recovery of heavy water by the dual temperature process for a number of systems are calculated. Efficient homogeneous catalysts have been found for two systems which show favorable separation and recovery factors, RNH_2–H_2 (R = H, etc.) and PH_3–H_2O. Preliminary engineering data and estimates of these processes show them to be attractive for production of heavy water if efficient gas-liquid contacting can be achieved at reasonable cost. Through the product rule, the G(u) function is obtained directly. The expansion of the latter, through the Bernoulli polynomials, leads to a power series in ϵ/kT, the power in the Boltzmann factor. The first term is that obtained by the more general method of the first quantum correction. In the first quantum correction approximation, the powerful method of the trace of the secular equation for the vibrational frequencies, leads to the rule of the geometric mean. The method of the trace can be applied to the higher powers of the Bernoulli polynomial and the range of applicability of the results of the first quantum correction is thus extended considerably. It is shown that this treatment of the higher order terms facilitates the theoretical interpretation of the relative separation factors of a series of isotopes of an element as well as the separation factors for complex systems. The separation factors can be expressed in terms of force constants and reciprocals of atomic masses without detailed solution of the secular equations of the vibrations. (auth)

Fluorine and Fluorine Compounds

11337 MLM-1076

Mound Lab., Miamisburg, Ohio.

DENSITY OF FUSED MIXTURES OF SODIUM FLUORIDE, BERYLLIUM FLUORIDE, AND URANIUM FLUORIDE. B. C. Blanke, E. N. Bousquet, L. V. Jones, E. L. Murphy, and R. E. Vallee. Apr. 1956. 89p. Contract AT-33-1-GEN-53. $12.30(ph OTS); $4.50 (mf OTS).

The density of mixtures in the ternary system sodium fluoride-beryllium fluoride-uranium fluoride was investigated by means of the determination of the loss in weight of a solid of known volume immersed in the fused mixture from the liquidus temperature to 900°C. The results have been assembled in tabular and graphical form. (auth)

Graphite

11338

THE ABSORPTION CROSS SECTION OF ELEMENTARY CARBON AND POLYCRYSTALLINE GRAPHITE. G. Gandusio and S. Polezzo (ENI, San Donato Milanese, Milan). Energia nucleare (Milan) 5, 383-6(1958) June. (In Italian)

Any reactor design requires an exact knowledge about the capture cross section of "passive" materials either in case of their use in total radiation absorption or of neutrons to a suitable velocity. In consideration of that, an accurate documentation on this subject is presented and the measurements of absorption cross section of carbon, in the form of polycrystalline graphite, exposed to a thermal neutron flux are examined critically. 17 references. (auth)

11339

FRICTION COEFFICIENTS OF GRAPHITE OVER THE TEMPERATURE INTERVAL 25°C TO 2450°C. Allen R. Driesner and Paul Wagner (Los Alamos Scientific Lab., N. Mex.). J. Appl. Phys. 29, 901-3(1958) June.

Measurements were made of the coefficients of friction for graphite and some graphite-based materials of interest for nuclear reactor application. Static and kinetic friction coefficients were measured as a function of surface conditioning and temperature up to a maximum temperature of 2450°C. In addition, the effects of force, stress, anisotropy, refractory coating, and uranium loading were studied. The most significant effect was found to be caused by the conditioning of the contact surfaces by polishing action, and this was more pronounced in the static than the kinetic friction coefficient. The friction coefficients increase with temperature. Other effects studied had negligible influence. (auth)

Laboratories and Equipment

11340 NAA-SR-Memo-1389
North American Aviation, Inc., [Downey, Calif.].
EFFICIENCY OF NaK BUBBLERS IN REDUCING THE OXYGEN CONTAMINATION OF HELIUM. W. Bradshaw and M. Tarpinian. June 3, 1955. 28p. $4.50(ph OTS); $2.70(mf OTS).

A sodium–potassium bubbler system for removing oxygen from helium was tested. The gas stream flows through a series of columns packed with stainless steel wool alternating with eutectic sodium–potassium (78% potassium). A determination of the oxygen present before and after treatment is obtained by use of a modified Brady apparatus. Effects of flow rate, helium pressure, and oxygen concentration are discussed along with the life expectancy of the eutectic and the effect of NaK temperature. (J.R.D.)

11341
INSTRUMENT DEVELOPMENTS IN HEALTH PHYSICS. F. E. Adley (General Electric Co., Richland, Wash.). Am. Ind. Hyg. Assoc. J. 19, 75-9(1958) Apr.

The performance characteristics and construction features are described for several instruments that were developed for specific applications in industrial hygiene in the nuclear energy industry. Two monitors, an automatic particle sampler and an NO_2 recorder, are discussed. An apparatus for testing respirator performance is shown. A reciprocating attachment for the random collection of particles by electrical precipitation is mentioned. Also reviewed are a microscope attachment for locating radioactive particles and a device for increasing the rapidity of manually measuring particle sizes from microprojections. Photographs are included. (auth)

11342
RADIO-FREQUENCY ANALYZERS FOR LABORATORY AND PLANT. D. J. Fisher, M. T. Kelley, R. W. Stelzner, and E. B. Wagner, Jr. (Oak Ridge National Lab., Tenn.). ISA Journal 4, 2-5(1957) Oct.

For the past several years, the Oak Ridge National Laboratory has been investigating the design and use of radio-frequency analyzers for service in both laboratory and plant. Several of these devices for continuously monitoring high concentrations of electrolytes in aqueous and non-aqueous liquids are described. All of these instruments can operate without electrodes immersed in the measured solution. (auth)

11343
SOME QUESTIONS RELATING TO THE TECHNIQUE OF RADIOCHEMICAL EXPERIMENTS. A. A. Goryunov (Novocherkassk Hydrochemical Inst.). J. Anal. Chem. U.S.S.R. (English Translation) 11, 629-36(1956) Sept.-Oct.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 1798.

11344
THE HANDLING OF RADIOACTIVE MATERIALS. R. Martin (Centre d'Etudes Nucleaires, Saclay, France). Rev. de la sécurité 8p. (1957). (In French)

The physical properties and biological effects of radiations are reviewed. Procedures and equipment for handling small quantities of radioactive materials are described. (C.H.)

Molecular Structure

11345
STRUCTURE AND MAGNETIC PROPERTIES OF SOME COMPLEX OXIDES OF THE TRANSITION ELEMENTS. Piet Frans Bongers. 'S-Gravenhage, Excelsior, [1957]. 58p. (In Dutch)

The structure and magnetic properties of some complex oxides of the transition elements were investigated to obtain a better insight into the deformations in spinels. Complex manganese or copper oxides with zinc, chromium, gallium, nickel, cobalt, or lithium were prepared and the structures were determined. Possible explanations of the deformations observed are discussed. (J.S.R.)

Radiation Chemistry

11346
EFFECT OF IONIZING RADIATION ON AQUEOUS SOLUTIONS OF GUANYLIC ACID AND GUANOSINE. G. Hems (Middlesex Hospital, London). Nature 181, 1721-2(1958) June 21.

Aqueous solutions of guanylic acid irradiated with high-energy electrons were analyzed by paper chromatography using an acid solvent. Two ultra-violet absorbing products were found, one of which had values identical with guanine in three solvent systems, and the other having spectra similar to those for products obtained by the alkylation of guanylic acid under mildly alkaline conditions. The radiation degradation of guanylic acid and guanosine are compared with that of corresponding adenine derivatives, where adenine is the sole ultra-violet absorbing product. (C.H.)

Radiation Effects

Refer also to abstract 11431.

11347 CF-58-6-91
Oak Ridge National Lab., Tenn.
STATUS OF SUBCONTRACT WORK ON EFFECTS OF RADIATION ON SOLVENT EXTRACTION PROCESSES. W. Davis, Jr. June 18, 1958. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The results of the Stanford Research Institute studies of the effects of radiation on solvent extraction processes are summarized, and a desirable direction for future work is indicated. Studies performed to date have shown that: (1) nearly all of the irradiation-induced increase in time required for TBP–Amsco–aqueous phase separation is due to formation of a polymer, of unknown chemical structure; (2) uranium retention by the TBP–Amsco phase during stripping operations is due approximately 65% to dibutyl phosphate and 20% to the polymer; (3) each 100 ev of energy absorbed forms about 0.5 hydrocarbon double bonds, with which fission product iodine could readily react; (4) dibutyl phenylphosphonate is about six times as resistant, and dibutyl butylphosphonate is twice as resistant, to radiation damage as is tributyl phosphate. (auth)

11348 NP-6723
Denver. Univ. Denver Research Inst.
DETERMINATION OF THE RELATIONS BETWEEN STRUCTURE AND RADIATION STABILITY OF VARIOUS CLASSES OF ALKYL AROMATIC FLUIDS. Quarterly Progress Report No. 3 [for] December 1957–April 1958. Don N. Gray. Apr. 1958. 20p. Project No. 7-(7-7331). Contract AF33(616)-5217.

The preparation of a number of alkyl-biphenyl and alkyl-o-and-p-terphenyl compounds has been continued. The radiation program has been continued with the

irradiation of n-heptylbiphenyl and n-heptyl-m-terphenyl. The gas liquid chromatographic apparatus available has been used to analyze gaseous decomposition products. Oxygen and nitrogen has been found in the gas which was caused by leakage of the container vessel due to haircracks. Irradiation thus took place in the presence of air. Analytical data will be utilized in connection with future experiments using irradiation in the presence of oxygen. (For preceding period see NP-6574.) (auth)

11349 WADC-TR-53-63(Pt. V)
Shell Development Co., Emeryville, Calif.
STABILITY OF JET TURBINE FUELS. PART V. EFFECT OF NUCLEAR RADIATION. Alan C. Nixon and Roy E. Thorpe. Apr. 1957. 79p. Project No. 1252. Contract AF33(616)-2707. (AD-118230).

The effects of ionizing radiation on jet fuels and their components were studied with respect to radiation-induced changes in thermal stability. Of three typical jet fuels, two improved in thermal stability at 450°F as a result of irradiation in air to 10^8 roentgens. A JP-4 fuel, on the other hand, was affected adversely, as judged by filter-plugging tendencies. The results of initial studies of radiation protectors indicate that the aromatic compounds investigated thus far do not generally extend sponge-type protection to jet fuels. (W.L.H.)

11350 WADC-TR-57-255(Pt. II)
Esso Research and Engineering Co., Linden, N. J.
NUCLEAR RADIATION RESISTANT TURBINE ENGINE LUBRICANTS. Final Report [for] February 1, 1957 to March 31, 1958. A. H. Matuszak. Apr. 15, 1958. 81p. Project title: RADIATION EFFECTS (MATERIALS). Task title: NUCLEAR RADIATION RESISTANT MATERIALS. Contract AF33(616)-3181. (RL-4M-58).

Twenty three finished mineral oils and base stocks have been screened at about 10^{10} ergs/gm c. The most attractive mineral oil from the standpoint of retention of original properties is a Grade 1065 Aviation Oil inhibited with phenyl-alpha-naphthylamine. A paraffinic base stock inhibited also with PANA looked equally attractive. These oils would be considered useful as Phase I type lubricants. At higher dosages of 5 and 10×10^{10} ergs/gm c these paraffinic oils showed increases in viscosities and flash point degradation but otherwise remained relatively radiation resistant. These two properties are viewed as their main deficiencies in limiting their use as jet engine lubricants at dosages higher than 10^{10} ergs/gm c. Some improvement can be obtained by incorporating aromatic components. In the synthetic field, fourteen formulated oils and thirty base stocks were evaluated. For Phase I application in the area of 10^{10} ergs/gm c, two dioctyl sebacate based formulations (Oil X and Oil Y) were selected not only because of their relatively good retention of physical properties at 10^{10} ergs/gm c but also because of the good all-around properties of dioctyl sebacate, its ready availability and its proven performance in jet engine operations. It was found necessary to incorporate about 25% of a more radiation resistant aromatic polyester into these oils in order to achieve satisfactory stable products. The most stable materials evaluated under this contract were aromatic esters which may be represented by Cabflex HS-10, an alkyl-aryl phthalate and Plasticizer HM, the aromatic polyester incorporated into the above Phase I oils. Although the Cabflex HS-10 has minor shortcomings particularly in metal corrosion at high dosages, it is the nearest approach to a Phase II type lubricant evaluated under the present contract. (auth)

11351
THE EFFECT OF NUCLEAR RADIATION ON THE BEHAVIOR OF CELLULOSE AND CELLULOSE DERIVATIVES. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 48, Session 5. Otto Teszler and Henry A. Rutherford (North Carolina State Coll., Raleigh). New York, American Institute of Chemical Engineers, 1958. 15p.

Cotton, rayon, and acetate samples were subjected to a series of neutron bombardments (25 different exposure levels) as well as gamma radiation (11 different levels). The radiation damage was evaluated with respect to changes in tenacity, elongation, stiffness, modulus, and viscosity. Also, qualitative determinations of changes in chemical groups were made. All cellulosics are greatly damaged by radiation. In all cases most of the damage occurred at the early stages of irradiation. The decreasing order of relative stability toward radiation is acetate-rayon-cotton. The effect of dose rate was investigated; the results showed that the damage is a function of total dose alone. (auth)

Rare Earths and Rare-earth Compounds

11352
THE PROPERTIES OF AMERICIUM AND EUROPIUM AND THEIR HOMOLOGY IN THE PERIODIC TABLE. G. E. Villar (Instituto de Tecnologia y Quimica de la Facultad de Ingeniería, Montevideo, Uruguay). Anales fac. quim. farm. 4, 33-40(1955). (In Spanish)

The physical and chemical properties of americium and europium are compared, and the differences which are found, especially in the valencies, indicate that the electron shells of the two are not necessarily the same. A $5f^6$, $6d^1$, $7s^2$ configuration is suggested for americium, although spectroscopic evidence indicates that europium has a $4f^7$, $6s^2$ configuration. (J.S.R.)

11353
ON THE THERMODYNAMICS OF THE RARE-EARTH METAL OXIDE CHLORINATION BY GASEOUS CHLORINE. I. S. Morozov and B. G. Korshunov (Kurnakov Inst. of General and Inorganic Chemistry). Doklady Akad. Nauk S.S.S.R. 119, 523-5(1958) Mar. 21. (In Russian)

The equilibrium of the reactions $4\ MeCl_3(t) + 3\ O_2(g) \rightleftharpoons 2\ Me_2O_3(t) + 6\ Cl_2(g)$ (where Me is Sc, La, Nd, and Sm) was investigated. Chlorination of oxides and oxidation of chlorides proceed without intermediate products. Analysis of Sc, La, Nd, and Sm oxides at 400° revealed the chlorides $ScCl_3$, $LaCl_3$, $NdCl_3$, and $SmCl_3$ with the ratio Me:3Cl equal to 0.421, 1.30, 1.32, and 1.40, respectively; theoretical figures are 0.424, 1.30, 1.36, and 1.42. (R.V.J.)

11354
CHROMATOGRAPHIC SEPARATION OF RADIOELEMENTS OF THE YTTRIUM GROUP OF ELEMENTS OBTAINED DURING FISSION OF YTTERBIUM AND HAFNIUM BY HIGH ENERGY PROTONS. A. A. Pozdyakov (V. I. Vernadsky Inst. of Geochemistry and Analytical Chemistry). J. Anal. Chem. U.S.S.R. (English Translation) 11, 605-10(1956) Sept.-Oct.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 1834.

Separation Procedures

Refer also to abstracts 11354 and 12094.

11355 AECU-3750
Massachusetts Inst. of Tech., Oak Ridge, Tenn. Enginnering Practice School.
ZIRCEX URANIUM SUBLIMATE LOSS. T. R. Jaworowski and C. J. King, III. Jan. 24, 1958. 23p. For [Oak Ridge Gaseous Diffusion Plant. Contract W-7405-eng-26, Subcontract No. 70]. (KT-310). $4.80(ph OTS); $2.70(mf OTS).

One of the limitations of the Zircex Process is the large percentage loss of U which is carried off with the volatile $ZrCl_4$. Since the ratio of U to Zr in the fuel element is quite small (< 1%), a large percentage of U loss can be caused by small amounts of U in the $ZrCl_4$ sublimate. The U loss must be kept below 1% if the Zircex Process is to be adapted to industrial scale processing. (W.L.H.)

11356 AECU-3751
Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.
ZIRCEX KINETICS AND URANIUM LOSS STUDY. T. J. Carter, Jr., and R. A. Stone. Nov. 13, 1957. 23p. For [Oak Ridge Gaseous Diffusion Plant. Contract W-7405-eng-26, Subcontract No. 70]. (KT-319). $4.80 (ph OTS); $2.70(mf OTS).

A study was made of the effects of temperature, impurities in the hydrogen chloride, flow rates, and niobium content on both the reaction rates and insoluble uranium losses in the Zircex Process is presented. (W.L.H.)

11357 CF-56-9-133
Oak Ridge National Lab., Tenn.
INTERFACIAL AREA BY ALPHA OR BETA DOSIMETRY—A FEASIBILITY STUDY. D. T. Morgan. Sept. 7, 1956. 27p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

A survey of chemical radiolysis methods of measuring interfacial area by means of short range particle irradiation of a liquid interface indicated the most promising system was an aqueous solution of polonium-210 in contact with a benzene solution of tetrachloroethylene. Experimentally, the rate of chloride liberation was quite low, and when measured by activation analysis, the specific rate of chloride production was subject to a very large relative error. (auth)

11358 CRCE-743
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
STUDY OF THE PROCESS VARIABLES IN THE ANION EXCHANGE PLUTONIUM SEPARATION PROCESS. D. T. Nishimura. Nov. 1957. 34p. (AECL-556). $1.00(AECL).

A study of the process variables in the Anion Exchange Process Pilot Plant for the separation of plutonium from irradiated uranium is discussed. Variables associated with the feed, wash, and elution cycles were studied with the aim of improving the quality of the final plutonium product, reduce cycling time and reagent requirements and also to obtain data for prediction of resin column behavior under various feed conditions. A cation resin column and a silica gel column were installed in the system and these were studied for plutonium recovery and product quality. The product obtained from the plant was acceptable in all the impurities except the associated gamma activity which was too high for easy product handling. (auth)

11359 DP-250
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
THE FORMATION AND EFFECTS OF DIBUTYL PHOSPHATE IN SOLVENT EXTRACTION. E. Kenneth Dukes. Nov. 1957. 22p. Contract AT(07-2)-1. $0.75(OTS).

Data are presented for the rates of formation of di-n-butyl phosphate (DBP) from tri-n-butyl phosphate. The effects of DBP on the extraction of zirconium from nitric acid and uranyl nitrate are reported. (auth)

11360 DP-283
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
REPROCESSING OF POWER REACTOR FUELS. First Quarterly Progress Report to January 1, 1958. Woodfin E. Shuler and Thomas H. Siddall, III. Apr. 1958. 14p. Contract AT(07-2)-1. $0.50(OTS).

This is the first quarterly progress report on investigations of chemical processing methods for zirconium–uranium fuel systems. Progress on removing zirconium jackets with hydrofluoric acid and ammonium fluoride; recovery of fissionable material from decladding solutions; dissolving uranium–molybdenum alloy in nitric acid and mixtures of nitric and hydrofluoric acid; stability of dissolver solutions; codissolving zirconium and uranium–molybdenum alloy with mixtures of nitric acid and hydrofluoric acid; and methods for separating zirconium and uranium before solvent extraction are summarized. (auth)

11361 RMO-2601
Merrill Co., San Francisco.
PROGRESS REPORT FOR THE PERIOD JUNE 13, 1951 TO AUGUST 31, 1951. John C. Huggins and Edward P. Bullwinkel. Sept. 7, 1951. Decl. Aug. 18, 1955. 36p. Contract AT(49-1)-540. $6.30(ph OTS); $3.00(mf OTS).

In an attempt to develop a method of recovering U and V from alkaline carbonate leach solutions, liquid Na amalgam was used to reduce the U and V. Maximum recoveries of 99% U and 98% V were obtained. The amount of V precipitated and the rate of precipitation were substantially increased by increasing the effectiveness of the contact between the solutions and the Na amalgam. The preparation and properties of amalgams and an experimental amalgam–solution contactor are discussed. (J.E.D.)

11362 RMO-2604
Merrill Co., San Francisco.
PROGRESS REPORT FOR THE PERIOD JANUARY 1, 1952 TO FEBRUARY 29, 1952. Leslie A. McClaine, John C. Huggins, and Edward P. Bullwinkel. Decl. Aug. 18, 1955. 28p. Contract AT(49-1)-540. $4.80 (ph OTS); $2.70(mf OTS).

The development of an economically more desirable method of recovering uranium and vanadium from alkaline carbonate leach solutions of uranium ores was undertaken. Details are presented on the design and construction of a continuous laboratory-scale process unit for the reduction of carbonate leach solution using sodium-amalgam. Data are also given on results of some initial operations of the continuous laboratory unit. Other studies also made during this period dealt with means or precipitate recovery from the reduced leach solution. (auth)

11363 RMO-2605
Merrill Co., San Francisco.
PROGRESS REPORT FOR THE PERIOD MARCH 1, 1952 TO APRIL 30, 1952. Leslie A. McClaine. Decl. Aug. 18, 1955. 44p. Contract AT(49-1)-540. $7.80(ph OTS); $3.30(mf OTS).

Investigation of the sodium-amalgam reduction of the carbonate leach solutions from carnotite ores was continued. Modifications made in the continuous process unit to improve operation are described, and difficulties not yet overcome are discussed. Data are given from a series of experiments designed to furnish more information on reaction characteristics. Discussion of the dependence of the reaction rate on amalgam concentration, interfacial contact area, vanadium concentration, and initial pH is presented. Calculated sodium efficiencies are presented as a function of amalgam concentration, and the economic signficance of the data obtained is discussed. (auth)

11364 RMO-2606
Merrill Co., San Francisco.
PROGRESS REPORT FOR THE PERIOD MAY 1, 1952 TO JUNE 30, 1952. Leslie A. McClaine. July 28, 1952. Decl. Aug. 18, 1955. 38p. Contract AT(49-1)-540. $6.30(ph OTS); $3.00(mf OTS).

Investigation of the sodium-amalgam reduction of carbonate leach solution was continued. Additional tests on the reaction characteristics of the process are presented. Tests were continued to obtain information on the operational characteristics of various types and modifications of column contactors in order to evolve a design best suited for use in a continuous production operation. Work was started on a program for the further investigation of electrolytic reduction of carbonate leach solutions. A diaphragm cell which was designed and constructed for the initial tests is described. The results are presented from a group of exploratory tests made to investigate the possibilities of using char sorption as a step in a process for the separation and/or recovery of uranium and vanadium. (auth)

11365 RMO-2608
Merrill Co., San Francisco.
PROGRESS REPORT FOR THE PERIOD JULY 1, 1952 TO AUGUST 29, 1952. Leslie A. McClaine. Dec. 15, 1952. Decl. Aug. 18, 1955. 38p. Contract AT(49-1)-540. $6.30(ph OTS); $3.00(mf OTS).

Test data are given on performance of solution spray columns in the process for the recovery of uranium and vanadium from carbonate leach solutions by sodium-amalgam. Studies are presented on the electrolytic precipitation of uranium and vanadium from carbonate leach solutions using a diaphragm cell with a mercury cathode. Test work includes studies on variation in current efficiency with cathode current density, evaluation of diaphragm materials, separate electrolytic precipitation of uranium and vanadium, use of cathode materials other than mercury, and regeneration of the barren leach solution. The results of a few tests using adsorption as a means for the recovery of uranium and vanadium are given. (auth)

11366 RMO-2609
Merrill Co., San Francisco.
A PRELIMINARY ECONOMIC ANALYSIS OF THE SODIUM–AMALGAM PROCESS. Leslie A. McClaine and Boyd L. Mahan. Nov. 1, 1952. Decl. Aug. 18, 1955. 41p. Contract AT(49-1)-540. $6.30(ph OTS); $3.00(mf OTS).

An economic analysis is presented of the sodium–amalgam reduction process for the recovery of uranium and vanadium from carbonate leach solutions. The analysis was made from laboratory test data obtained to date. Methods and the basis of calculations are given for each step in the analysis. (auth)

11367 RMO-2610
Merrill Co., San Francisco.
PROGRESS REPORT FOR THE PERIOD SEPTEMBER 1, 1952 TO OCTOBER 31, 1952. Leslie A. McClaine. Jan. 15, 1953. Decl. Aug. 18, 1955. 62p. Contract AT(49-1)-540. $9.30(ph OTS); $3.60(mf OTS).

The work performed during the period on process development for recovery of uranium and vanadium from carbonate leach solutions is reported. Work presented on the electrolytic precipitation of uranium and vanadium includes studies on cathode materials, diaphragm materials, effects of modifying operating variables and experimental procedure, and tests utilizing the low vanadium leach solution received recently from Monticello. Test work is reported on the regeneration of the barren leach solution in the sodium-amalgam process. Other studies are reported on packed columns, leach solution with high initial pH, mercury losses, and results obtainable with low-vanadium leach solution. Additional studies are reported on the possibilities of adsorption as a recovery method. Qualitative studies on the chemistry of uranium in carbonate solutions are discussed in conjunction with the process development studies. (auth)

11368 RMO-2613
Merrill Co., San Francisco.
SUMMARY AND COST ESTIMATES USING ELECTROLYTIC REDUCTION IN SELECTED FLOWSHEETS. John C. Huggins and Robert A. Carlson. Apr. 17, 1954. Decl. Aug. 18, 1955. 32p. Contract AT(49-1)-540. $4.80(ph OTS); $2.70(mf OTS).

Preliminary cost estimates on selected methods for the recovery of uranium and vanadium from carbonate leach solutions utilizing a mercury cathode cell are presented. The conditions considered in this report are not necessarily the optimum but serve as a basis of comparison. Operating costs for all of the processes considered are favorable in comparison to the method of acidifying the carbonate solution to recover the uranium and vanadium. The range of operating costs, plus plant amortization, reported are from $1.23 PTS to $4.79 PTS. The operating costs presented exclude labor and maintenance. Capital costs reported are relatively high for the various processes, being in the range of from $1,700 to $5,500/ton solution/day, but these may be substantially reduced at a slight increase in operating costs. (auth)

11369 RMO-2615
Merrill Co., San Francisco.
EXTRACTION OF URANIUM FROM LA VENTANA LIGNITE. I. F. Schwien. Mar. 24, 1954. Decl. Aug. 18, 1955. 28p. Contract AT(49-1)-540. $4.80(ph OTS); $2.70(mf OTS).

The extraction of uranium from raw lignite as well as from lignite ash samples was investigated. The uranium extractions obtainable under various leaching conditions and procedures are compared. Raw lignite yielded 92% of its uranium to carbonate leach solutions, and a uranium recovery of 96% was realized by a dilute sulfuric acid leach at 95°C of a lignite ash. (auth)

11370 WIN-32
National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.
RESIN-IN-PULP PILOT PLANT TESTING OF HIDDEN SPLENDOR ORES. D. O. Skiles and R. L. Shimin. Jan. 20, 1956. Changed from OFFICIAL USE ONLY Sept. 5, 1957. 50p. Contract AT(49-6)-924. $7.80 (ph OTS); $3.30(mf OTS).

Information is presented on the leaching, ion ex-

change, and precipitation involved in processing ore from the Delta Mine of the Hidden Splendor Mining Company. Results show the ore to be amenable to the Resin-in-Pulp Process. (auth)

11371 NP-tr-106

FLOTATION BY FATTY ACIDS AT LOW PULP TEMPERATURES. V. I. Klassen. Translated by J. Adam (U.K.A.E.A., Atomic Energy Research Establishment) from Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk No. 5, 136-8(1957). 6p.

A method was developed for the preparation of fatty acids for flotation. In the experiments oleic acid was used as the collector and the ores subject to flotation were those containing polar minerals for which useful flotation is effected when pulp is heated to about 20°C. (W.L.H.)

11372

ON FOCUSING ION EXCHANGE. V. SEPARATION OF METAL IONS, ESPECIALLY RADIOACTIVE INDICATORS BY EXCHANGE WITH PROTONS. E. Schumacher and H. J. Streiff (Univ. of Zurich). Helv. Chim. Acta 41, 824-43(1958). (In German)

Focusing ion exchange (FI) has extensively been studied using a pH gradient for producing a gradient in chelating tendency. NTA, EDTA, Chel CD, Chel ME, and Chel DE are complexing agents, HCl or $HClO_4$ in suitable concentrations are complex-destroying agents. Apparatus for FI-separation on paper-strips is described. A simple radiograph for evaluation of separated activity-distributions has been in use for over a year. pH plotted against length of strip shows two distinct steps, one in the strong acid region between pH 0 and 1, one between pH 2 and 6, $0.8 < pH < 2$ is a region of smoothly varying pH, where separations preferentially take place. The value of the electrical field along the strip is discussed. The influence of process-parameters on separation has been evaluated with Co, Cu and Ba, and Sr rare earths as test-mixtures. Optimal conditions are found. Some applications are mentioned, such as separation of Cs^{137} from alcaline earths, rapid qualitative analyses of some alloys, rapid analysis of a fission mixture of activities, qualitative analysis of group II-ions, and analysis of rare earths-mixtures. Some interesting observations in regard to complex-chemistry are made: all complexing agents used are forming ammonium-ions in pH 0 to 1 region. This has several implications on the separation process and on the magnitude of measured stability constants, NTA complexes of rare earths show anionic behavior probably by taking up Cl^- or F^- ion. (auth)

11373

METHODS OF ISOLATING CARRIER FREE RADIOACTIVE ISOTOPES. PART I. PREPARATION OF RADIOCHEMICALLY PURE ThB AND ThC. N. P. Rudenko (Moscow State Univ.). J. Anal. Chem. U.S.S.R. (English Translation) 11, 385-90(1956) July–Aug.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 199.

11374

AN EXPRESS DROP-DESORPTION METHOD FOR THE SEPARATION AND IDENTIFICATION OF SHORT-LIVED RADIOELEMENTS. K. V. Troitsky (V. I. Vernadsky Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR, Moscow). J. Anal. Chem. U.S.S.R. (English Translation) 11, 399-404(1956) July–Aug.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 6538.

11375

SEPARATION OF BERYLLIUM FROM ALUMINUM AND OTHER ELEMENTS BY AN EXTRACTION METHOD. I. P. Alimarin and I. M. Gibalo (M. V. Lomonosov Moscow State Univ.). J. Anal. Chem. U.S.S.R. (English Translation) 11, 405-8(1956) July–Aug.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 200.

11376

SEPARATION OF NIOBIUM AND TANTALUM WITH ORGANIC HYDROXAMIC ACIDS AND PHENYLARSONIC ACID. Anil Kumar Majumdar and Asit Kumar Mukherjee (Jadavpur Univ., Calcutta). Naturwissenschaften 45, 239-40(1958).

An investigation of the separation of niobium and tantalum with organic hydroxamic acids reveals that salicylhydroxamic acid precipitates both elements in the presence of a tartrate from highly acid solutions to solutions with a maximum pH of 6.4. With citrate the pH of the solution can be extended only to 3.0. With oxalate tantalum precipitates under the same pH conditions as with tartrate, but niobium begins to precipitate at pH 4.9. Cinnamyl hydroxamic acid behaves in the same way as the salicyl derivative with the pH of precipitation extended to 6.5 in oxalate solution, 8.5 in tartrate solution, and 2.0 for tantalum and 2.8 for niobium in citrate solution. With phenylarsonic acid tantalum can be precipitated from an ammonium oxalate–sulfuric acid solution, but the complete precipitation of niobium occurs only when the pH is over 4.8. (J.S.R.)

11377

THOREX SHORT COOLED PROCESSING. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 122, Session 37. A. B. Meservey and R. H. Rainey (Oak Ridge National Lab., Tenn.). New York, American Institute of Chemical Engineers, 1958. 7p.

The conventional Thorex flowsheet for the aqueous processing of long-decayed neutron-irradiated thorium slugs gives poor decontamination from iodine and ruthenium when short-decayed slugs are processed. Good decontamination is obtained after a head-end treatment with potassium iodide and the addition of sodium bisulfite to the feed. (auth)

11378

THE BEHAVIOUR OF RUTHENIUM IN THE FIXATION OF FISSION PRODUCTS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 67, Session 16. W. E. Erlebach and R. W. Durham (Atomic Energy of Canada, Ltd., Chalk River, Ont.). New York, American Institute of Chemical Engineers, 1958. 25p.

At some stage in most high-temperature processes for incorporating fission product wastes in a solid siliceous matrix, ruthenium compounds are oxidized to a volatile form. When a mix of fission products in nitric acid and ground nepheline syenite is dried, denitrated, and fused, ruthenium is lost at each stage. The drying stage loss, which usually approaches 100 percent of the ruthenium in the mix, can be eliminated by neutralizing the mixture. The loss during denitration of a strongly basic mix may amount to 0.5% of the ruthenium. The loss during the subsequent fusion stage of a neutralized

mix, which may reach 70 percent of the ruthenium, can be substantially reduced by heating the mix in an atmosphere such as carbon dioxide. (auth)

Sorption Phenomena

11379 AECU-3752

Utah. Univ., Salt Lake City. Inst. for the Study of Rate Processes.

CARBON DIOXIDE ADSORPTION ON THORIA. Technical Report No. 1. Charles H. Pitt and Milton E. Wadsworth. Feb. 15, 1958. 22p. For Oak Ridge National Lab., Contract W-7405-eng-26, Subcontract 1075. $3.30(ph OTS); $2.40(mf OTS).

Carbon dioxide was adsorbed on samples of thoria having a surface area of 30 m^2/g. The amount adsorbed was measured gravimetrically using a quartz spring and cathetometer. Adsorption isotherms were obtained for a series of temperatures after degassing at 650°C. Isosteric heats and enthalpy of adsorption were determined from the adsorption isotherms. The isotherms obtained may be explained by an adsorption process involving a linear variation of adsorption potential with surface coverage. Below approximately 200°C an unusual increase in adsorption is observed which can be explained by postulating the presence of two types of adsorption sites. A theoretical interpretation of results is given. (auth)

11380

ARGON ADSORBED ON A GRAPHITIC SURFACE. THE HEAT OF ADSORPTION FROM LATTICE LIQUID THEORY. E. L. Pace (Western Reserve Univ., Cleveland). J. Chem. Phys. 27, 1341-6(1957) Dec.

A model is proposed to account for the differential or isosteric heat of adsorption which has been observed for argon on graphite at concentrations between 0.5 and 2.0 monolayers for temperatures in the neighborhood of the normal boiling point of argon. The energy of a molecule on the surface is considered to be the sum of the contributions of a site energy for the isolated molecule and an interaction energy with neighbors in the same layer. The site energy for a molecule is calculated assuming atoms and molecules in lower layers fixed with respect to both a configuration in a hexagonally packed planar lattice and the distance between layers. The interaction energy is calculated assuming the behavior in any layer is represented by a two dimensional lattice liquid model utilizing the so-called Ono approximation for the variation of the generalized free volume with vacancies in the lattice. The distribution of adsorbed molecules in any layer is considered to be completely random. On the basis of this model, an interpretation is made of the two maxima in the isosteric heat which have been observed experimentally. (auth)

Tracer Applications

11381

USE OF ION ACCELERATION FOR LABELING CHEMICAL COMPOUNDS. F. Cacace, G. Giacomello, and M. Zifferero (Centro di Chimica Nucleare del C.N.R., Rome). Energia nucleare (Milan) 5, 387-92(1958) June.

A new method for introducing a radioactive tracer inside a molecule, recoil labeling, will prevent the many inconveniences presented by conventional labeling procedures. A survey is presented of the experimental results of this technique. 11 references. (J.S.R.)

Transuranic Elements and Compounds

Refer also to abstract 11352.

11382 AERE-C/R-847(Del.)

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE REACTIONS OF BROMINE TRIFLUORIDE WITH PLUTONIUM, URANIUM AND THEIR COMPOUNDS. J. K. Dawson and A. E. Truswell. Jan. 2, 1952. Decl. with amendments Nov. 26, 1956. 12p.

Plutonium and its compounds were shown to be very much less reactive towards bromine trifluoride than the corresponding uranium compounds. This is most probably due to the greater stability of UF_6 over PuF_6 and the fact that plutonium systems tend to produce protective films of a non-volatile lower fluoride. Oxides of the Group V elements have a marked catalytic effect on the reaction of bromine trifluoride with metallic uranium and plutonium, while considerably less catalytic effect is shown by potassium fluoride and by bromine. The mechanism of the reaction between uranium and bromine trifluoride is discussed. (auth)

11383 AERE-M/R-2416

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE CRYSTAL STRUCTURES OF PLUTONIUM: THE DELTA AND EPSILON PHASES. J. G. Ball, P. Greenfield, P. G. Mardon, and J. A. L. Robertson. 1958. Date of MS. Apr. 1954. Decl. June 1956. 14p. $0.45 (BIS).

Declassified version of AERE-M/R-1409.

The experimental procedure for obtaining x-ray-diffraction photographs from plutonium metal, between room temperature and 530°C is described. The data for diffraction lines of two of the high temperature phases are tabulated and interpretations of the structures are given. (auth)

Uranium and Uranium Compounds

Refer also to abstracts 11330, 11471, 12095, 12096, 12097, and 12101.

11384 AECD-4266

Carbide and Carbon Chemicals Co. [K-25 Plant], Oak Ridge, Tenn.

VARIATION OF CRITICAL PARAMETERS BETWEEN U-235 ASSAYS OF 4.9 PERCENT AND 93.4 PERCENT. H. F. Henry and C. E. Newlon. Oct. 23, 1953. Decl. with deletions June 3, 1958. 14p. Contract W-7405-eng-26. (KS-399(Del.)). $3.30(ph OTS); $2.40(mf OTS).

The minimum critical mass, volume, and cylinder diameter for U of 4.9% U^{235} assay were determined as 1.83 kg, 32.1 liters, and 10.7 in., respectively. Curves have also been prepared by applying the same constant correction to each minimum parameter curve that was used in establishing "always-safe" values for 93.4% assay material. These reduction curves may serve as possible criteria for establishing "always-safe" values over a wide range of U^{235} assays. (W.L.H.)

11385 AECU-3729

[Westinghouse Electric Corp. Research Labs., East Pittsburgh, Penna.]

FURTHER STUDIES ON THE MECHANISM OF OXIDATION OF URANIUM DIOXIDE. Research Report 100FF942-R3. Joseph Weissbart, Paul E. Blackburn,

and Earl A. Gulbransen. June 6, 1957. 34p. For [Westinghouse Electric Corp. Atomic Power Div. Contract AT-11-1-GEN-14]. $6.30(ph OTS); $3.00 (mf OTS).

The results of x-ray and density studies of the UO_2 oxidation products indicate that UO_2 oxidizes by the immediate formation of a surface γ-tetragonal U_3O_7 phase. This process is controlled by the diffusion of oxygen through the second phase. Analysis of the $\alpha-UO_2$ lattice parameters demonstrates that the solubility of oxygen in UO_2 below 300°C is less than one atom % per mole of UO_2. The stability of U_3O_7 and the interpretation of other results are discussed. X-ray-diffraction data for the phases, UO_2, U_4O_9, U_3O_7, and U_3O_8 are tabulated. (auth)

11386 CRCE-716

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

PREPARATION OF URANIUM DIOXIDE FOR USE IN CERAMIC FUELS. PART III. AMMONIUM DIURANATE REDUCTION STUDIES. A. R. Bancroft and L. C. Watson. May 1958. 27p. (AECL-586). $1.00(AECL).

Uranium dioxide can be prepared by the reduction of ammonium diuranate with hydrogen at elevated temperatures. The results of a study made to define the effects of the reduction conditions on the sintered density of the uranium dioxide compacts are described. Seven variables which might be expected to affect the properties of the uranium dioxide were investigated using ammonium diuranate samples of three different qualities simultaneously for all tests. (auth)

11387 SCNC-241

Sylvania-Corning Nuclear Corp., Bayside, N. Y.

THE CARBOTHERMIC REDUCTION OF URANIUM OXIDE. R. M. Powers, O. J. Blaber, C. I. Whitman, and R. B. Holden. June 27, 1957. Decl. Aug. 6, 1957. 140p. Contract AT-30-1-GEN-366. $3.75(OTS).

Uranium oxide has been reduced by carbon under vacuum at 2250°C, to yield a product consisting of dendritic uranium carbide in a matrix of uranium. Uranium sponge is obtained from this cermet by hydrolyzing the interconnected UC. This is followed by pickling in dilute nitric acid to remove the residual hydrolysis product $UO_2 \times H_2O$ from the metal. As carried out on the 100-pound scale, the average over-all yield of uranium from 21 reductions was 31.2% per reduction cycle. The uranium is of high purity and is in a form that is well suited to direct arc melting with or without alloying, clad rolling, or powder metallurgical consolidation. (auth)

11388 WAPD-PWR-CP-2427

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

WAPD-29-1 EXPERIMENT. Paul Cohen. Sept. 10, 1956. 4p. $1.80(ph OTS); $1.80(mf OTS).

The proposal for a dynamic in-pile test of UO_2 fuel specimens at the MTR is presented. (W.L.H.)

11389 AEC-tr-3286

INVESTIGATIONS OF THE SYSTEM $U_3O_8-ZrO_2$. Leonhard Ochs. Translated for Westinghouse Electric Corp. Atomic Power Div. from Z. Naturforsch. 12a, 215-22(1957). 20p. (Translation partially illegible).

It is concluded that ZrO_2 and U_3O_8 do not affect each other enough to make ZrO_2 unsuitable as structural material in a reactor. However, for use at high temperatures a ZrO_2 stabilized with CaO at 2000°C is recommended. (T.R.H.)

11390

THE COMPOSITION OF URANYL SELENITE. A VOLUMETRIC METHOD OF DETERMINING URANIUM. M. K. Djoshi (Benares Univ., India). J. Anal. Chem. U.S.S.R. (English Translation) 11, 525-6(1956) July-Aug.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 201.

11391

TREATMENT OF URANIUM ORES. III. J. Beranek and F. Holub (Chemical Research, Prague). Jaderna Energie 4, 93-8(1958) Apr. (In Czech)

Descriptions are given of the uranium ore pilot plant under construction in Czechoslovakia. Various processes for leaching uranium ores, precipitation of uranium salts, and the use of ion exchange in various types of equipment are discussed. The performance of plant equipment and the construction materials are analyzed. The problems of health protection of the personnel handling radioactive materials are also considered. (tr-auth)

11392

WORLD'S PRODUCTION OF URANIUM. V. Rypar (Ministry of Chemical Industry). Jaderna energie 4, 128-32(1958) May. (In Czech.)

A review is given of the world's production of uranium and of the various methods of recovery. The flow sheet of typical chemical recovery of uranium concentrates, the uranium extraction from wet process phosphoric acid, and recovery from slurries by ion exchange are described. (R.V.J.)

Waste Disposal

11393

NUCLEAR ENERGY DEVELOPMENTS AND OCEANOGRAPHY. Nature 181, 1685-6(1958) June 21.

Problems associated with the disposal of radioactive waste by discharge into the sea are discussed. Present research and regulatory activities throughout the world are summarized. (C. H.)

ENGINEERING

Refer also to abstract 12099.

11394 NP-6774

Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.

MEANS FOR PRODUCING AND MAINTAINING VERY LOW TEMPERATURES. Final Report, September 2, 1947 to February 28, 1958. S. C. Collins. Apr. 14, 1958. 65p. ONR Project No. NR 017-203. Contract N5 ori-07823.

An analysis of refrigeration cycles and heat exchange systems which led to an improved liquefaction cycle is given as an introduction to a description of the practical improvements in refrigeration apparatus. A detailed description is given of the new helium liquefier. Experiments made of continuous refrigeration below 4.2°K are discussed. Experiments were made of the use of liquid helium as an aid in the production of high vacua, of low-temperature measurements within the helium storage vessel, and with persistent currents. A miniature helium refrigerator, which is completely automatic and required only power and cooling water, is described. (J.S.R.)

11395
VALVES FITTED WITH ADJUSTABLE MICROLEAKS. J. Amoignon, J. Delcher, and R. Geller (Centre d'Etudes Nucléaires, Saclay, France). Le Vide No. 68, 176-83 (1957) Mar.-Apr. (In French)

Two microleak valves for use in gas-measuring or vacuum systems are described, one adjustable by mercury level, the other by compression of rubber ring seals. A method of calibration of good accuracy is discussed. (T.R.H.)

11396
THE SCOPE OF PRESSURE VESSEL CODES AND ACTIVITIES TOWARD IMPROVED CONTENT. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 78, Session 3. W. E. Cooper (General Electric Co., Schenectady, N. Y.). New York, American Institute of Chemical Engineers, 1958. 23p.

A summary of the scopes of codes currently available for pressure vessel design and certain activities directed toward the improved technical content and coverage of such codes, particularly for application to nuclear reactor components are discussed. (auth)

11397
DESIGN BASIS FOR THERMAL STRESSES. W. E. Cooper (General Electric Co., Schenectady, N. Y.). Proc. Soc. Exptl. Stress Anal. 15, 143-7(1958).

The factors which must be considered in the establishment of a structural design basis are considered. These factors include the operational conditions, stress and deformation analysis, general design requirements, fabrication, and stress limits. Attention is restricted to ductile materials at a temperature sufficiently low that long time elevated temperature properties do not control the design. The need for extensive experimental investigations of material and component behavior is emphasized. (auth)

11398
AUTOMATIC FILM WASHER-RINSER-DRYER. Louis E. Owen (Goodyear Atomic Corp., Portsmouth, Ohio). Spectrochim. Acta 12, 99-100(1958).

An automatic film washer-rinser-dryer for processing strip film is described. A schematic sketch and circuit diagram are included. (C.H.)

Heat Transfer and Fluid Flow

Refer also to abstract 11827.

11399 BRL-962
Ballistic Research Labs., Aberdeen Proving Ground, Md.
SOME ASPECTS OF THREE-DIMENSIONAL BOUNDARY LAYER FLOWS. R. Sedney. Sept. 1955. 26p. DA Project No. 5B03-03-001.

The equations for laminar boundary layer flow over a general surface in three-dimensions are analyzed in a normal coordinate system. The invariance properties of these equations are found using the concept of subtensors. The boundary layer equations are not tensor equations but subtensor equations. Conditions for the Cartesian form of the equations are given and a criterion for no secondary flow is found in terms of the geodesics of the body surface. The displacement effect of the boundary layer is also discussed. (auth)

11400 NACA-TN-4141
Ames Aeronautical Lab., Moffett Field, Calif.
THE USEFUL HEAT CAPACITY OF SEVERAL MATERIALS FOR BALLISTIC NOSE-CONE CONSTRUCTION. Jackson R. Stalder. Nov. 1957. 18p.

An analysis has been made of the heat-absorption characteristics of copper, Inconel-X, graphite, and beryllium. It was found that significant weight saving could be achieved in a ballistic missile heat sink by the use of graphite or beryllium in place of copper. Inconel-X was found to be unsatisfactory because of its low thermal conductivity. It is indicated that large errors in computed temperature distributions in materials can arise if the variation of thermal properties with temperature is not taken into account. (auth)

11401
THE RANDOM-WALK MODEL WITH AUTOCORRELATION OF FLOW THROUGH POROUS MEDIA. A. E. Scheidegger (Imperial Oil Ltd., Calgary, Alberta, Can.). Can. J. Phys. 36, 649-58(1958) June.

In pursuit of the idea of applying statistical mechanics to the theory of flow through porous media, an investigation was made of the implications of a random-walk model as opposed to random residence-time models. Although the random-walk model is physically not as satisfactory as other statistical models, it has the advantage of enabling one to introduce and to investigate easily the effect of autocorrelation between subsequent time steps. It is shown that, if autocorrelation exists, the mixing process in porous media is governed by a telegraph equation rather than by a diffusivity equation. Expressions for the constants occurring in the telegraph equation are deduced in terms of other dynamical variables. (auth)

11402
SOME STEADY RELATIVISTIC FLOWS. K. P. Stanyukovich. Doklady Akad. Nauk S.S.S.R. 119, 251-4(1958) Mar. 11. (In Russian)

Equations are developed for adiabatic and relativistic steady flow of media possessing symmetry. (R.V.J.)

11403
HEAT TRANSFER IN SWIRLING LAMINAR PIPE FLOW. R. Siegel and M. Perlmutter (Lewis Flight Propulsion Lab., Cleveland). J. Appl. Mech. 25, 295-7(1958) June.

The fluid motion resulting from tangential swirl on the heat transfer for a uniform heat flux applied at the pipe wall was determined. The thermal-entry region for Poiseuille flow without swirl was recalculated using the present numerical method for comparison with the swirl computation. (J.R.D.)

Materials Testing

Refer also to abstracts 11445 and 11828.

11404 AECU-3708
Brown Univ., Providence. Metals Research Lab.
THEORY OF THE THERMAL BREAKAWAY OF A PINNED DISLOCATION LINE WITH APPLICATION TO DAMPING PHENOMENA. Louis J. Teutonico, Andrew Granato, and Kurt Lücke. May 1, 1958. 140p. Contracts DA-19-020-ORD-3650; AT(30-1)-1772; and AF18(603)-136. $21.30(ph OTS); $6.90(mf OTS).

An investigation is made of the model of a pinned dislocation line under stress. The model used is that originally given by Koehler and later employed by Granato and Lücke in their theory of mechanical damping due to dislocations. By taking into account thermal fluctuations, the probability of the thermal unpinning (breakaway) of such a dislocation line is calulated. The effect of this breakaway on the decrement and apparent modulus change felt by a stress wave traveling through a solid is also considered. The decrement is found to be both hysteretic and relaxational in nature: hysteretic,

since the dislocation is irreversibly broken away from the pinning agents; relaxational, since the dislocation passes with a temperature-dependent mean frequency from one configuration of minimum energy through a saddle point configuration to another minimum configuration. A comparison of this theory with the Granato-Lücke theory of mechanical damping (of which the present work is both an extension and a modification) reveals the following: (1) This theory contains the effect of temperature which the Granato-Lücke theory does not. The results of this theory reduce to those of Granato and Lücke when the temperature approaches zero. (2) This theory appears to have the proper frequency dependence while the results of the Granato-Lücke theory are frequency independent. (3) The dependence of the decrement on stress is slightly different in this theory from that in the Granato-Lücke theory, but thus far experimental results do not determine which is more appropriate since both seem to fit the available data rather well. (auth)

11405 AERE-M/R-2485
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE EFFECT OF NEUTRON IRRADIATION ON THE IMPACT PROPERTIES OF En2 MILD STEEL. I. L. Mogford, A. T. Churchman, and D. Hull. Feb. 1958. 12p.

The impact properties of En2 mild steel have been measured after irradiation with neutrons to a maximum integrated dose of 9.3×10^{19} neutron cm^{-2}. The increase in the transition temperature is approximately proportional to the cube root of the dose. At the maximum dose the rise in transition temperature is 75°C. There is a reduction in the energy absorbed in ductile fracture after irradiation which is approximately 50% for specimens given high doses. (auth)

11406 AFOSR-TN-58-221
Minnesota. Univ., Minneapolis. Inst. of Tech.
ELASTIC INSTABILITY OF RECTANGULAR SANDWICH PANEL OF ORTHOTROPIC CORE WITH DIFFERENT FACE THICKNESSES AND MATERIALS. Composite Structure Report No. 1. Chieh C. Chang and Ibrahim K. Ebcioglu. Mar. 1958. 60p. Contract AF18(603)-112. (AD-154122).

The elastic instability of rectangular sandwich panels of orthotropic core and faces with different materials and unequal thicknesses is treated. The panel is simply supported and loaded with edge compression. The differential equations and corresponding boundary conditions are derived from the classical energy integral by means of the variational method. The critical edge compression per unit width can be expressed as a product of two parts: the major buckling coefficient and critical buckling load. The complicated geometrical parameters and different component materials are included in a single graph. The effect of different face temperatures on the maximum collapsing load can be interpreted from the present theory. A comparison with current different methods is given. A number of illustrating examples are shown. (auth)

11407 HW-55516
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
ORGANIC COOLANT DEVELOPMENT, ORA-3 LOOP. Interim Report III. G. E. Neibaur. Mar. 13, 1958. 5p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $.180(mf OTS).

The results of tests of commercial valve packings, various gaskets, an air-operated valve, an expansion joint, and a graphite sample are presented. The tests were conducted in the organic thermal convection loop which has a design temperature and pressure of 800°F and 600 psi and a normal operating temperature and pressure of about 600°F and 150 psi. (J.R.D.)

11408 NACA-TN-3786
New York Univ., New York.
HANDBOOK OF STRUCTURAL STABILITY. PART VI. STRENGTH OF STIFFENED CURVED PLATES AND SHELLS. Herbert Becker. July 1958. 85p.

A comprehensive review of failure of stiffened curved plates and shells is presented. Panel instability in stiffened curved plates and general instability of stiffened cylinders are discussed. The loadings considered for the plates are axial, shear, and the combination of the two. For the cylinders, bending, external pressure, torsion, transverse shear, and combinations of these loads are considered. When possible, test data and theory were correlated. (auth)

11409 SCR-12
Sandia Corp., Albuquerque, N. Mex.
SOLID LUBRICANT COATINGS. L. M. Berry. Apr. 1958. 26p. Contract AT(29-1)-789. $4.80(ph OTS); $2.70(mf OTS).

Quantitative data on some of the variables affecting the performance of solid dry-film lubricants are presented. Included is a discussion of the test background, theory, methods used, sample pre-test treatment, and variables tested. (J.R.D.)

11410 AEC-tr-3226
AN ACCELERATED METHOD OF DETERMINING THE DURABLE RESISTANCE LIMIT OF WOOD. V. F. Yatsenko (Jazenko). Translated from Dopovidi Adad. Nauk Ukr. R.S.R., No. 1, 33-6(1958). 7p.

An accelerated method is presented for determining the durable resistance limit of wood based on the theory of resistance and deformation of this material as an elastic, plastic, and viscous body. Ordinary testing machines can be used, and the time required to conduct a test is about 1 to 2 hours. (J.R.D.)

Pumps

11411 WAPD-PWR-PC-983
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SURGE PROTECTION FOR MAIN COOLANT PUMP MOTORS. N. E. Wilson. Sept. 3, 1957. 9p. $1.80 (ph OTS); $1.80(mf OTS).

Insulation breakdown in stator windings of Shippingport Pressurized Water Reactor main coolant pump motors during tests is discussed. Transient voltages in the 2400-v system used in the tests were suspected. Proposals for surge protection are made and discussed. (T.R.H.)

11412
A GUIDE TO THE SELECTION OF CANNED MOTOR PUMPS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 77, Session 2. W. M. Wepfer (Westinghouse Electric Corp., Cheswick, Penna.). New York, American Institute of Chemical Engineers, 1958. 13p.

Typical design and performance parameters are shown for a wide range of sizes of canned-motor pumps. Twenty of the questions most frequently asked by prospective users are discussed and answered. (auth)

11413
DIAPHRAGM FEED PUMPS FOR HOMOGENEOUS REACTORS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 74, Session 2. Charles H. Gabbard (Union Carbide Nuclear Co., Oak Ridge, Tenn.). New York, American Institute of Chemical Engineers, 1958. 15p.

High-pressure low-capacity feed pumps are required in homogeneous reactors to return the fuel solution to the high-pressure system and to provide purge water to the pressurizers and to the circulating pump motors. The hydraulically actuated diaphragm pump seems best to meet the following requirements imposed by the corrosive environment and the high radiation level: (1) must be absolutely leak free, (2) must have a long maintenance free life, and (3) must be easily replaceable, if necessary. Problems encountered in the development of a 1.5 gpm diaphragm pump for the Homogeneous Reactor Test are discussed. These problems pertain mainly to the development of suitable check valves for water and uranyl sulfate, and to the development of suitable diaphragms for long term service. In connection with the diaphragm life, the following items are discussed: (1) contour shape and diaphragm stress, (2) a method of studying the dynamic deflection of the diaphragm, and (3) the effect of corrosion on the endurance limit of 347 stainless steel. (auth)

11414
HIGH TEMPERATURE MECHANICAL "CANNED MOTOR" LIQUID METAL PUMPS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 76, Session 2. Oliver P. Steele, III (Westinghouse Electric Corp., Cheswick, Penna.). New York, American Institute of Chemical Engineers, 1958. 18p.

Studies of certain type nuclear power plants to employ superheated steam has placed emphasis on sodium and sodium–potassium alloys as high-temperature heat transfer mediums. After careful consideration of all various pumping problems for handling these materials, a mechanical "canned motor" pump was considered to have the greatest success potential. The design problems and their solutions are outlined. Pumps of this type have already been produced in sizes to 700 horsepower and for stream temperatures to 1500°F. (auth)

Tracer Applications

11415
LOCATION OF LEAKS WITH RADIOISOTOPES IN MULTIWALLED TANKS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 75, Session 1. William F. Sullivan and James R. Coleman (National Lead Co., Sayreville, N. J.). New York, American Institute of Chemical Engineers, 1958. 9p.

A technique is described for locating leaks in multiwalled tanks and has been successfully applied to the location of leaks in lead lined, wooden tanks. By dissolving radioiodine in an oil layer, it is possible to introduce the isotope into the leak channel and then remove all surplus radioactivity from the tank. Residual radioactivity is detected with a portable survey meter and the original leak site located readily by external measurement. (auth)

11416
RADIOACTIVE TRACERS IN EXTREME PRESSURE LUBRICATION. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 70, Session 1. E. H. Loeser, R. C. Wiquist, and S. B. Twiss (Chrysler Corp., Detroit). New York, American Institute of Chemical Engineers, 1958. 31p.

A review has been made of the recent literature on the use of radioactive isotopes incorporated in extreme pressure oil additives for investigating the mechanism of wear reduction and scuff prevention. These additives form chemically-reacted films which have been studied under both static and dynamic conditions. The activity of the additive appears to be a function of concentration, temperature, pressure and nature of the wear surface. Original work is presented on the use of radioactive phosphorus-32 contained in zinc dialkyl dithiophosphate, which is widely used in engine oils to prevent wear and scuffing in valve trains. Studies of oil decomposition and static immersion tests are reported. Most important are dynamic studies carried out in a bench scale cam and tappet tester under various load and speed conditions. Radioactive determinations were made by means of a Geiger counter and by autoradiographs of both cam and tappet surfaces. (auth)

Vacuum Systems

11417
ELECTRONIC ULTRA-HIGH VACUUM PUMP. Lewis D. Hall (Varian Associates, Palo Alto, Calif.). Rev. Sci. Instr. 29, 367-70(1958) May.

An ultra-high vacuum pump has been developed based on the combined effects of ionization, excitation, and sputtering. A cold-cathode discharge in magnetic field is employed with no hot filaments nor moving parts. The ultimate vacuum attainable is not yet known but is probably below 2×10^{-10} mm Hg. A pumping speed of about 10 liters/sec for air has been recorded at 1×10^{-7} mm Hg. The pump replaces liquid nitrogen-trapped oil diffusion pumps for pumping microwave tubes. (auth)

Waste Disposal

11418 WAPD-PWR-CP-1945
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
WASTE DISPOSAL TREATMENT OF PWR HOT LAUNDRY AND DECONTAMINATION ROOM WASTES. Paul Cohen. Mar. 23, 1956. 3p. Appendix I: SURVEY OF APPLICATION OF STANDARD WATER CLARIFICATION PROCEDURES TO PWR LAUNDRY AND DECONTAMINATION ROOM WASTES. R. Lloyd. 11p. (WAPD-PWR-CP-1912). Appendix II: CONFERENCE BETWEEN R. LLOYD AND J. R. LaPOINTE TO ESTABLISH TENTATIVE PROCEDURES AND DETERMINE EQUIPMENT FOR APPLYING ADSORPTION-FLOCCULATION TREATMENT TO PWR LAUNDRY WASTE. R. Lloyd and J. R. LaPointe. 4p. (WAPD-PWR-CP-1929). Appendix III: EVAPORATION OF DECONTAMINATION ROOM WASTES. C. S. Abrams. 4p. (WAPD-PWR-CP-1930). (WAPD-PWR-CP-1945, $1.80(ph OTS); $1.80(mf OTS); WAPD-PWR-CP-1912, $3.30(ph OTS); $2.40(mf OTS); WAPD-PWR-CP-1929 and WAPD-PWR-CP-1930, $1.80(ph OTS); $1.80(mf OTS) ea.)

This report and three appendixes were issued separately, but are cataloged as a unit.

The necessity for treatment of hot laundry and decontamination room wastes prior to disposal at the

since the dislocation is irreversibly broken away from the pinning agents; relaxational, since the dislocation passes with a temperature-dependent mean frequency from one configuration of minimum energy through a saddle point configuration to another minimum configuration. A comparison of this theory with the Granato-Lücke theory of mechanical damping (of which the present work is both an extension and a modification) reveals the following: (1) This theory contains the effect of temperature which the Granato-Lücke theory does not. The results of this theory reduce to those of Granato and Lücke when the temperature approaches zero. (2) This theory appears to have the proper frequency dependence while the results of the Granato-Lücke theory are frequency independent. (3) The dependence of the decrement on stress is slightly different in this theory from that in the Granato-Lücke theory, but thus far experimental results do not determine which is more appropriate since both seem to fit the available data rather well. (auth)

11405 AERE-M/R-2485
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE EFFECT OF NEUTRON IRRADIATION ON THE IMPACT PROPERTIES OF En2 MILD STEEL. I. L. Mogford, A. T. Churchman, and D. Hull. Feb. 1958. 12p.

The impact properties of En2 mild steel have been measured after irradiation with neutrons to a maximum integrated dose of 9.3×10^{19} neutron cm^{-2}. The increase in the transition temperature is approximately proportional to the cube root of the dose. At the maximum dose the rise in transition temperature is 75°C. There is a reduction in the energy absorbed in ductile fracture after irradiation which is approximately 50% for specimens given high doses. (auth)

11406 AFOSR-TN-58-221
Minnesota. Univ., Minneapolis. Inst. of Tech.
ELASTIC INSTABILITY OF RECTANGULAR SANDWICH PANEL OF ORTHOTROPIC CORE WITH DIFFERENT FACE THICKNESSES AND MATERIALS. Composite Structure Report No. 1. Chieh C. Chang and Ibrahim K. Ebcioglu. Mar. 1958. 60p. Contract AF18(603)-112. (AD-154122).

The elastic instability of rectangular sandwich panels of orthotropic core and faces with different materials and unequal thicknesses is treated. The panel is simply supported and loaded with edge compression. The differential equations and corresponding boundary conditions are derived from the classical energy integral by means of the variational method. The critical edge compression per unit width can be expressed as a product of two parts: the major buckling coefficient and critical buckling load. The complicated geometrical parameters and different component materials are included in a single graph. The effect of different face temperatures on the maximum collapsing load can be interpreted from the present theory. A comparison with current different methods is given. A number of illustrating examples are shown. (auth)

11407 HW-55516
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
ORGANIC COOLANT DEVELOPMENT, ORA-3 LOOP. Interim Report III. G. E. Neibaur. Mar. 13, 1958. 5p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $.180(mf OTS).

The results of tests of commercial valve packings, various gaskets, an air-operated valve, an expansion joint, and a graphite sample are presented. The tests were conducted in the organic thermal convection loop which has a design temperature and pressure of 800°F and 600 psi and a normal operating temperature and pressure of about 600°F and 150 psi. (J.R.D.)

11408 NACA-TN-3786
New York Univ., New York.
HANDBOOK OF STRUCTURAL STABILITY. PART VI. STRENGTH OF STIFFENED CURVED PLATES AND SHELLS. Herbert Becker. July 1958. 85p.

A comprehensive review of failure of stiffened curved plates and shells is presented. Panel instability in stiffened curved plates and general instability of stiffened cylinders are discussed. The loadings considered for the plates are axial, shear, and the combination of the two. For the cylinders, bending, external pressure, torsion, transverse shear, and combinations of these loads are considered. When possible, test data and theory were correlated. (auth)

11409 SCR-12
Sandia Corp., Albuquerque, N. Mex.
SOLID LUBRICANT COATINGS. L. M. Berry. Apr. 1958. 26p. Contract AT(29-1)-789. $4.80(ph OTS); $2.70(mf OTS).

Quantitative data on some of the variables affecting the performance of solid dry-film lubricants are presented. Included is a discussion of the test background, theory, methods used, sample pre-test treatment, and variables tested. (J.R.D.)

11410 AEC-tr-3226
AN ACCELERATED METHOD OF DETERMINING THE DURABLE RESISTANCE LIMIT OF WOOD. V. F. Yatsenko (Jazenko). Translated from Dopovidi Adad. Nauk Ukr. R.S.R., No. 1, 33-6(1958). 7p.

An accelerated method is presented for determining the durable resistance limit of wood based on the theory of resistance and deformation of this material as an elastic, plastic, and viscous body. Ordinary testing machines can be used, and the time required to conduct a test is about 1 to 2 hours. (J.R.D.)

Pumps

11411 WAPD-PWR-PC-983
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SURGE PROTECTION FOR MAIN COOLANT PUMP MOTORS. N. E. Wilson. Sept. 3, 1957. 9p. $1.80 (ph OTS); $1.80(mf OTS).

Insulation breakdown in stator windings of Shippingport Pressurized Water Reactor main coolant pump motors during tests is discussed. Transient voltages in the 2400-v system used in the tests were suspected. Proposals for surge protection are made and discussed. (T.R.H.)

11412
A GUIDE TO THE SELECTION OF CANNED MOTOR PUMPS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 77, Session 2. W. M. Wepfer (Westinghouse Electric Corp., Cheswick, Penna.). New York, American Institute of Chemical Engineers, 1958. 13p.

Typical design and performance parameters are shown for a wide range of sizes of canned-motor pumps. Twenty of the questions most frequently asked by prospective users are discussed and answered. (auth)

11413
DIAPHRAGM FEED PUMPS FOR HOMOGENEOUS REACTORS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 74, Session 2. Charles H. Gabbard (Union Carbide Nuclear Co., Oak Ridge, Tenn.). New York, American Institute of Chemical Engineers, 1958. 15p.

High-pressure low-capacity feed pumps are required in homogeneous reactors to return the fuel solution to the high-pressure system and to provide purge water to the pressurizers and to the circulating pump motors. The hydraulically actuated diaphragm pump seems best to meet the following requirements imposed by the corrosive environment and the high radiation level: (1) must be absolutely leak free, (2) must have a long maintenance free life, and (3) must be easily replaceable, if necessary. Problems encountered in the development of a 1.5 gpm diaphragm pump for the Homogeneous Reactor Test are discussed. These problems pertain mainly to the development of suitable check valves for water and uranyl sulfate, and to the development of suitable diaphragms for long term service. In connection with the diaphragm life, the following items are discussed: (1) contour shape and diaphragm stress, (2) a method of studying the dynamic deflection of the diaphragm, and (3) the effect of corrosion on the endurance limit of 347 stainless steel. (auth)

11414
HIGH TEMPERATURE MECHANICAL "CANNED MOTOR" LIQUID METAL PUMPS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 76, Session 2. Oliver P. Steele, III (Westinghouse Electric Corp., Cheswick, Penna.). New York, American Institute of Chemical Engineers, 1958. 18p.

Studies of certain type nuclear power plants to employ superheated steam has placed emphasis on sodium and sodium–potassium alloys as high-temperature heat transfer mediums. After careful consideration of all various pumping problems for handling these materials, a mechanical "canned motor" pump was considered to have the greatest success potential. The design problems and their solutions are outlined. Pumps of this type have already been produced in sizes to 700 horsepower and for stream temperatures to 1500°F. (auth)

Tracer Applications

11415
LOCATION OF LEAKS WITH RADIOISOTOPES IN MULTIWALLED TANKS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 75, Session 1. William F. Sullivan and James R. Coleman (National Lead Co., Sayreville, N. J.). New York, American Institute of Chemical Engineers, 1958. 9p.

A technique is described for locating leaks in multiwalled tanks and has been successfully applied to the location of leaks in lead lined, wooden tanks. By dissolving radioiodine in an oil layer, it is possible to introduce the isotope into the leak channel and then remove all surplus radioactivity from the tank. Residual radioactivity is detected with a portable survey meter and the original leak site located readily by external measurement. (auth)

11416
RADIOACTIVE TRACERS IN EXTREME PRESSURE LUBRICATION. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 70, Session 1. E. H. Loeser, R. C. Wiquist, and S. B. Twiss (Chrysler Corp., Detroit). New York, American Institute of Chemical Engineers, 1958. 31p.

A review has been made of the recent literature on the use of radioactive isotopes incorporated in extreme pressure oil additives for investigating the mechanism of wear reduction and scuff prevention. These additives form chemically-reacted films which have been studied under both static and dynamic conditions. The activity of the additive appears to be a function of concentration, temperature, pressure and nature of the wear surface. Original work is presented on the use of radioactive phosphorus-32 contained in zinc dialkyl dithiophosphate, which is widely used in engine oils to prevent wear and scuffing in valve trains. Studies of oil decomposition and static immersion tests are reported. Most important are dynamic studies carried out in a bench scale cam and tappet tester under various load and speed conditions. Radioactive determinations were made by means of a Geiger counter and by autoradiographs of both cam and tappet surfaces. (auth)

Vacuum Systems

11417
ELECTRONIC ULTRA-HIGH VACUUM PUMP. Lewis D. Hall (Varian Associates, Palo Alto, Calif.). Rev. Sci. Instr. 29, 367-70(1958) May.

An ultra-high vacuum pump has been developed based on the combined effects of ionization, excitation, and sputtering. A cold-cathode discharge in magnetic field is employed with no hot filaments nor moving parts. The ultimate vacuum attainable is not yet known but is probably below 2×10^{-10} mm Hg. A pumping speed of about 10 liters/sec for air has been recorded at 1×10^{-7} mm Hg. The pump replaces liquid nitrogen-trapped oil diffusion pumps for pumping microwave tubes. (auth)

Waste Disposal

11418 WAPD-PWR-CP-1945
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
WASTE DISPOSAL TREATMENT OF PWR HOT LAUNDRY AND DECONTAMINATION ROOM WASTES. Paul Cohen. Mar. 23, 1956. 3p. Appendix I: SURVEY OF APPLICATION OF STANDARD WATER CLARIFICATION PROCEDURES TO PWR LAUNDRY AND DECONTAMINATION ROOM WASTES. R. Lloyd. 11p. (WAPD-PWR-CP-1912). Appendix II: CONFERENCE BETWEEN R. LLOYD AND J. R. LaPOINTE TO ESTABLISH TENTATIVE PROCEDURES AND DETERMINE EQUIPMENT FOR APPLYING ADSORPTION-FLOCCULATION TREATMENT TO PWR LAUNDRY WASTE. R. Lloyd and J. R. LaPointe. 4p. (WAPD-PWR-CP-1929). Appendix III: EVAPORATION OF DECONTAMINATION ROOM WASTES. C. S. Abrams. 4p. (WAPD-PWR-CP-1930). (WAPD-PWR-CP-1945, $1.80(ph OTS); $1.80(mf OTS); WAPD-PWR-CP-1912, $3.30(ph OTS); $2.40(mf OTS); WAPD-PWR-CP-1929 and WAPD-PWR-CP-1930, $1.80(ph OTS); $1.80(mf OTS) ea.)

This report and three appendixes were issued separately, but are cataloged as a unit.

The necessity for treatment of hot laundry and decontamination room wastes prior to disposal at the

Shippingport Pressurized Water Reactor site is pointed out, and means for accomplishing this are discussed. A feasible procedure suggested consists of an adsorption-flocculation treatment with supernate disposal by dilution, pass through an evaporator, transfer to surge and decay tanks, with final sludge concentration in drums for retention and burial at sea. (T.R.H.)

11419

RADIOACTIVE LIQUID WASTE DISPOSAL FROM THE DRESDEN NUCLEAR POWER STATION. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 102, Session 16. C. F. Falk (General Electric Co., San Jose, Calif.). New York, American Institute of Chemical Engineers, 1958. 11p.

The Dresden Nuclear Power Station, a boiling water reactor, will produce wastes which are variable in quantity, radioactivity, and chemical concentration. Design of an economical liquid and solid waste disposal system is complicated by this variety. The paper presents the basis of design and criteria for safe disposal of these radioactive wastes. A description is given of the sources of waste, treatment processes, and disposal methods. Equipment arrangement and operating and control philosophy are also presented. (auth)

11420

TREATMENT OF RADIOACTIVE WASTES USING ION TRANSFER MEMBRANES: REMOVAL OF BULK ELECTROLYTES. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 55, Session 16. E. A. Mason, E. J. Parsi, and A. J. Giuffrida (Ionics, Inc. and Massachusetts Inst. of Tech., Cambridge). New York, American Institute of Chemical Engineers, 1958. 35p.

Use of anion transfer membranes in electrolytic cells has been investigated as a means of removing and separating bulk electrolytes from cationic fission products. Nitric acid and aluminum nitrate were used as typical electrolytes, and sodium was used as a tracer representing cationic species. Deacidification of nitric acid and precipitation of hydrous aluminum oxide in granular form were accomplished. The mechanism of deacidification, effect of operating variables, and stability of membranes to chemical and radiation attack are discussed. A brief cost estimate is included. (auth)

11421

A FIELD TEST OF THE MOVEMENT OF RADIOACTIVE CATIONS THROUGH AN UNDERGROUND FORMATION. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 64, Session 35. Ben B. Ewing (Univ. of California, Berkeley). New York, American Institute of Chemical Engineers, 1958. 37p.

The Sanitary Engineering Research Laboratory of the University of California, Berkeley, has been studying the feasibility of underground disposal of radioactive wastes. As part of this project, a synthesized radioactive waste containing Sr^{89} and Cs^{134} was injected into a confined permeable underground formation and its movement traced by radioassay of samples from monitoring wells distributed at various distances from the injection well. The results were correlated with field-scale hydraulic flow tests and a laboratory investigation of the ion-exchange properties of earth material taken from the same formation. The radioactivity pumped from the well during redevelopment was also investigated. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

Ceramics and Refractories

11422 YAEC-59

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

DEVELOPMENT OF A METHOD FOR ROLL CLADDING, SILVER, BORON–CARBIDE CERMETS WITH AISI 304 STAINLESS STEEL. Lawrence Lewis—Jean F. Soppet, ed. May 1, 1958. 23p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $4.80(ph OTS); $2.70(mf OTS).

An investigation was made to determine whether AISI 304 stainless steel could be roll-bonded to itself at 1650°F or less, and whether a composite material of silver, boron carbide, clad with AISI 304 stainless steel could be roll-bonded. A variety of rolling schedules was used, and the resulting samples were metallographically evaluated. (auth)

11423 AEC-tr-3239

THE PREPARATION OF PURE HIGH-MELTING CARBIDES, NITRIDES, AND BORIDES BY THE DEPOSITION METHOD AND THE DESCRIPTION OF THEIR PROPERTIES. K. Moers. Translated by Lydia Venters from Z. anorg. u. allgem. Chem. 198, 243-61 (1931). 22p.

A method is presented for dissociation of high melting substances in the form of halogen, hydrogen, or oxygen compounds which deposit appropriate carbides, nitrides, borides, and others in a pure stable form on a high-melting glowing wire. The carbides, nitrides, and borides of zirconium, titanium and vanadium; the carbide and boride of hafnium; the carbide and nitride of tantalum, the carbide of silicon, and the boride of tungsten were prepared by this method. (J.R.D.)

11424

SINTERING UNDER PRESSURE OF ALUMINA AND BERYLLIA. R. Caillat and R. Pointud (Centre d'Etudes nucleaires, Saclay, France). Rev. met. 54, No. 4, 277-82(1957). (In French)

The influence of temperature and pressure sintering, together with the time of application of this pressure, on the density of sintered discs made from pure alumina and berylia powder is examined. Densities close to the maximum theoretical density are quickly, reached from 1,600 °C onwards, under pressures of about 200 kg/cm^2. The crystalline texture of the products obtained is studied simultaneously. The experimental results are discussed according to several advanced theories. (auth-tr)

11425

ELABORATION OF SEVERAL REFRACTORY PIECES USED IN METALLURGICAL LABORATORIES. R. Pointud and J. Roger (Centre d'Etudes nucleaires, Saclay, France). Rev. mét. 54, No. 4, 283-7(1957). (In French)

The techniques are described by which one is able to obtain alumina, magnesia, lime, thoria, uranium dioxide and calcium fluoride crucibles and boats of large size. Special attention has been given to the purity of the products. (auth-tr)

Corrosion

11426 AFOSR-TR-58-73
Horizons, Inc., Cleveland.
INVESTIGATION OF THE CORROSIVE COMPONENT OF MECHANICAL WEAR. Final Progress Report. Raymond H. Baskey. May 1, 1958. 112p. Contract AF18(600)-1589. (AD-158313).

Measurements were made of corrosive wear on sliding steel surfaces as a function of load, distance of travel, and frequency of rotation past a given area in such a manner that the effects of adhesion and abrasion of the base metal were eliminated. Corrosive wear (frictional oxidation) is a combination of corrosion and mechanical wear in which freshly-formed oxide layers are sheared off. The following conclusions were reached: The shearing resembles regular adhesive wear, however, here the shearing is presumably all in the brittle oxide layer where cohesive strength is less than for fresh metal. Oxide film forms rapidly on rubbing surfaces with poor lubrication, but slowly with oil lubricant due to O_2 dissolved in the oil. After run-in, the corrosive wear varies linearly with distance of travel. As frequency increases, wear volume decreases. Oxidation depends on the time interval, temperature of asperities, oxygen present, and ambient temperature. For brass rubbing against oxidized iron, frequency has an effect similar to that for steel on steel. Aluminum oxidation cannot be measured by Knoop impressions as the oxide particles erode the base metal. Wear volume increases with temperature from 40 to 72°F, is constant from 72° to 150°F and increases rapidly to 200°F. For steel on steel friction, the contacting surfaces oxidize, the rate being accelerated by localized surface heating. In all probability, the physical forces on the oxide film cause distortion, cracking, and break down which accelerates oxidation. (T.R.H.)

11427 CF-57-1-26
Oak Ridge National Lab., Tenn.
CARBON STEEL IN HIGH TEMPERATURE WATER. G. E. Moore. Jan. 31, 1957. 34p. Contract W-7405-eng-26. $6.30(ph OTS); $3.00(mf OTS).

Resistance of carbon steel to corrosion in oxygenated high-temperature (250°C) water was unexpectedly good at high oxygen concentration. Pertinent literature, critically examined, and toroid experiments indicated that at low oxygen concentration attack did increase with concentration, but as oxygen concentration was sufficiently increased, more protective films were formed on the metal. Some corrosion factors in the application of carbon steel to nuclear reactor systems are discussed. (auth)

11428 CF-58-6-11
Oak Ridge National Lab., Tenn.
TEST PROGRAM FOR PAR IN-PILE SLURRY LOOP EQUIPMENT. Lester J. King. June 4, 1958. 9p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The major portions of the test program required for demonstrating the operability and dependability of the PAR in-pile slurry loop complex are listed. The responsibility for making the tests is divided to give Westinghouse the responsibility for assembling the loop, loop auxiliaries, and controls and demonstrating their satisfactory operation out of pile and to give ORNL the responsibility for testing radiation monitoring systems and instruments, carriers and tools for handling the radioactive loop and samples, and loop segmenting equipment. The program for test runs at the reactor site is outlined. (auth)

11429 CF-58-6-59
Oak Ridge National Lab., Tenn.
EXAMINATION OF CORROSION SPECIMENS FROM SLURRY BLANKET MOCKUP RUN SM-4. S. A. Reed and E. L. Compere. June 9, 1958. 13p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

Generally low attack rates were displayed by specimens of type 347 stainless steel, titanium-75A, and Zircaloy-2 which were exposed for 2396 hr in slurry blanket mock-up Run SM-4. The leading coupon of the array, of type 347 stainless steel, suffered more severe attack due to erosive action by the slurry. Coupons of SA-212-B carbon steel were consumed during the run. No stress corrosion cracking was noted on samples, placed in the pressurizer, of types 347 and AM 350 stainless steels, titanium-6A14V alloy, or Zircaloy-2. (auth)

11430 DP-269
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
PINHOLE CORROSION TESTING OF ALUMINUM-CLAD, NICKEL-BONDED FUEL ELEMENTS. Carl L. Angerman and Earle C. Hoxie. Feb. 1958. 24p. Contract AT(07-2)-1. $0.75(OTS).

A corrosion test was developed to indicate the quality of the bond between the aluminum cladding and nickel-plated uranium core of fuel elements. The rate of corrosive attack was found to be dependent upon the distribution of the oxide phase in the bond. (auth)

11431
ATMOSPHERIC CORROSION OF METALS UNDER RADIATION. A. V. Byalobzheskii (Inst. of Physical Chemistry, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 119, 515-17(1958) Mar. 21. (In Russian)

Investigations were made of radiation effects on the corrosion processes in iron, copper, aluminum, stainless steel, and zinc in the atmosphere with 98% humidity. The results showed that in many instances the ionizing radiation intensified corrosion processes in the metals. (R.V.J.)

Geology and Mineralogy

11432 CEA-707
France. Commissariat à l'Énergie Atomique, Paris.
LA RADIOACTIVITÉ DES VOSGES HERCYNIENNES. (The Radioactivity of the Hercynian Vosges.) J. P. Rothé. 1957. 20p.

A radiogeologic map is presented and discussed which permits establishment of numerous geologic correlations and explains some of the fundamental characteristics of the structure of the Vosges. This map raises some points of investigation for petrographers and geophysicists: the origin of the more or less large radioactivity of different petrographic units; variation of the radioactivity with the petrographic aspect; and possible correlation of age with the position of the units. Answers to these questions are proposed and discussed. (T.R.H.)

11433 RME-3152
Columbia Univ., New York.
STRUCTURAL CONTROL OF URANIUM DEPOSITS, SIERRA ANCHA REGION, GILA COUNTY, ARIZONA. Floyd J. Williams. Aug. 1957. 117p., 2 illus. Contract AT(30-1)-1195. $3.25(OTS).

The discovery and exploitation of primary uranium mineralization in the Sierra Anchas of east-central Arizona made possible an analysis of the structural ore controls. An older Precambrian metamorphic and granite complex is covered by the younger Precambrian Apache group of sediments and the Cambrian Troy formation. The sediments are generally flat-lying and broken by steep-dipping normal faults. Extensive, thick, diabase sills have penetrated several thinly bedded horizons. Although the region is within the mountain belt of Arizona, the structural framework is similar to that of the Colorado Plateau, which is expressed physiographically by the Magollon Plateau 20 miles to the north. The investigation was carried out in four phases: (a) detailed mapping of uranium occurrences, (b) field measurement and analysis of jointing over the region, (c) analysis of fractures taken from aerial photographs, and (d) petrographic and chemical investigation of the sediments, diabase intrusives, and uranium ores. Results of the work indicate three types of structural controls which are responsible for localization of the uranium deposits. (auth)

11434 RME-3155

Minnesota. Univ., Minneapolis.

ANNUAL REPORT FOR APRIL 1, 1957 TO MARCH 31, 1958. John W. Gruner. May 1, 1958. 14p. Contract AT(30-1)-610. $3.30(ph OTS); $2.40(mf OTS).

A short field season of three weeks permitted study of newly opened mines in South Dakota, Wyoming, and New Mexico. Emphasis was placed on rock coloration of the country rock in the ore areas. Studies of the coloration did not yield any conclusive results. A number of experiments with crude oils and "dried" crude oils show conclusively that uranium is easily precipitated at 120 to 125°C as uraninite if the pH of the aqueous solution in contact with the oil is below 8. When Ca-uranyl tricarbonate is acted on under these conditions, uraninite and calcite form which is similar to a number of natural occurrences. The temperature of 120 to 125°C was used to speed up the reaction which otherwise might have taken years. No H_2S could be detected in the oils. Boltwoodite, a new uranyl silicate described by Frondel and Ito in 1956, was found in at least 15 different localities in four states, but always in such minute amounts that analyses and, therefore, proper classification were impossible. (auth)

11435 TEI-123

Geological Survey.

RECONNAISSANCE FOR URANIFEROUS LIGNITES IN NORTH DAKOTA, SOUTH DAKOTA, MONTANA, AND WYOMING. Ernest P. Beroni and Herman L. Bauer, Jr. July 1952. Decl. Mar. 9, 1956. 80p., 8 illus. $2.50(OTS).

Detailed studies were made at Bullion and Sentinel Buttes, in Slope, Billings, and Golden Valley Counties, N. Dak. Investigations of these areas were followed by a general reconnaissance for uraniferous lignites in North Dakota, eastern Montana, north-central Wyoming, and northwestern South Dakota. Deposits of uraniferous lignites were discovered at Blue Buttes, eastern Montana; and at North Cave Hills, South Cave Hills, and at Slim Buttes in northwestern South Dakota. The only lignites that contain appreciable amounts of uranium are in the upper part of the Sentinel Butte shale member of the Fort Union formation in southwestern North Dakota and eastern Montana, and in the Ludlow formation in northwestern South Dakota. The uranium content of the individual lignite beds ranges from 0.002 to 0.033% uranium and after ignition the uranium content of the ash ranges from 0.010 to 0.091% uranium. Natural ash contains as much as 0.025% uranium; natural clinker or scoria and carbonaceous clay are lower grade than the lignites; and some spring waters contain as much as 0.09 ppm of uranium. The inferred reserves of uraniferous lignites in North Dakota, South Dakota, and Montana are estimated to be 183,320,000 short tons that contain a weighted average of 0.009% uranium. The potential energy and amount of material available for liquid fuel conversion in this quantity of lignite is very large. The inferred reserve of ash which would result from the burning of these uraniferous lignites is 60,266,000 short tons containing 0.023% uranium. The total amount of uranium (metal) in the known uraniferous lignite in North Dakota, South Dakota, and Montana is estimated to be about 12,600 short tons. The prospect of finding additional radioactive lignite beds is believed to be good. (auth)

11436

EXCESS HELIUM AND ARGON IN BERYL AND OTHER MINERALS. Paul E. Damon and J. Laurence Kulp (Columbia Univ., New York). Am. Mineralogist 43, 433-59(1958) May-June.

All beryl crystals appear to contain a quantity of helium and argon in great excess over that which can be accounted for from radioactive decay. Other magnetic minerals which have structural sites suitable for large non-essential atoms such as cordierite and tourmaline also show this excess in variable amount. It seems that this excess inert gas must represent a sample of the magnetic gases in the immediate environment of the forming crystal and as such can provide useful information on magnetic conditions. Although there are considerable differences in the helium and argon concentration even in the same beryl crystal, these are small compared to the one hundred-fold difference between crystals formed in the early Precambrian (~3.0 b.y.) and Paleozoic eras. This strong age effect is interpreted as suggesting more extensive outgassing of the mantle in the earlier phases of earth history. (auth)

11437

A CHALCEDONY-LIKE VARIETY OF GERMANIA. J. F. White, E. R. Shaw, and J. F. Corwin (Antioch Coll., Yellow Springs, Ohio). Am. Mineralogist 43, 580-4(1958) May-June.

A fibrous variety of GeO_2 (quartz type) was produced by hydrothermally. It has anomalous physical and optical properties which are analogous to the corresponding form of silica, chalcedony. Accordingly, this variety may be termed chalcedonic germania. Refractive indices determined for single crystals of GeO_2 (quartz type) are slightly different from those previously reported. (auth)

11438

ON A SUDDEN AND LIMITED VARIATION OF THE RADIOACTIVITY OF A GRANITE MASS. Marcel Roubault and René Coppens. Compt. rend. 246, 3086-9 (1958) May 28. (In French)

Several kilometers from Vannes (Morbihan) a sharp variation in activity of a granite mass was found with two bands several hundred meters in length and 3 or 4 meters wide. The bands join forming a Y and at that point the activity reaches 140 c/sec AVP. The alignments marked are indicative of the existence of a uraniferous vein. However, the increase in activity is caused by a concentration of microscopic inclusions of monazite. (J.S.R.)

11439

URANIUM-BEARING AURIFEROUS REEFS AT JACO-

BINA, BRAZIL. J. D. Bateman. Econ. Geol. 53, 417-25(1958) June-July.

Near Jacobina, Brazil, are uranium-bearing gold deposits in reef-type conglomerates of Proterozoic age. Uraninite and gold occur in association with pyrite in the matrix of closely packed quartz pebble conglomerates. A comparison of the geological and geochemical features is made with the Witwatersrand gold ores and the Blind River uranium deposits, leading to the conclusion that, in the three widely separated areas, the deposits are the product of a similar metallogenetic cycle of erosion, sedimentation, and mineral deposition restricted to a late Precambrian epoch. (auth)

11440

PROSPECTING APPARATUS. C. Lallemant (CEA, C.E.N., Saclay, France). Ind. Atom. 2, No. 5-6, 89-100(1958). (In French)

Radiogeological prospecting is discussed and the SP-4 Scintillometer for use in a vehicle and the AVP 500 Gammameter for systematic prospecting are described. A probe with a photomultiplier for weak activities or spectrographic studies is also described. (T.R.H.)

Metals and Metallurgy

Refer also to abstracts 12102, 12103, and 12104.

11441 AGC-AE-40

Aerojet-General Corp., Azusa, Calif.

THE REACTION OF ZIRCALOY-2 WITH WATER AND WITH URANYL SULFATE FUEL SOLUTION. Final Report [for] June 3, 1957 through March 1, 1958. H. M. Higgins. Mar. 25, 1958. 70p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract 1089. $7.80 (ph OTS); $3.30(mf OTS).

The reaction of molten Zircaloy-2 spray with water and with uranyl sulfate fuel solution was investigated. It was concluded that there is no significant difference between the HRT fuel solution and water as an oxidizer for molten Zircaloy-2 droplets. Tests were performed to determine the extent of burning of Zircaloy-2 and zirconium in water, uranyl sulfate fuel solution, oxygen, and steam at pressures up to 2000 psig. Self-sustaining reactions of these metals could not be initiated in the liquid media or in pure steam. Self-sustained burning was easily established in steam containing as little as 0.5 vol. % oxygen. Moreover, when the burning of a half-submerged wire was initiated in the steam-oxygen zone and allowed to propagate into the liquid, the burning continued under water to a greater or lesser extent, depending on the temperature of the water. (auth)

11442 BMI-1070(Del.)

Battelle Memorial Inst., Columbus, Ohio.

PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING JANUARY 1956. Russell W. Dayton and Clyde R. Tipton, Jr. Feb. 1, 1956. Decl. with deletions Mar. 6, 1958. 84p. Contract W-7405-eng-92. $13.80(ph OTS); $4.80(mf OTS).

The effect of heat treatment on the hardness of Al-U, Si-U, and U-Zr alloys is presented. The solubility limit of U in high-purity Th is being determined. One-thousand-hour creep tests were completed on transverse sheet specimens of cold-worked and of annealed Zircaloy-2. Results are included. Results are presented on the change of lattice parameters with temperature for UO_2 oxidized in air or oxygen at room temperature. The reactivity of UO_3 and the UO_2 obtained therefrom was investigated as a function of denitration temperature in a laboratory continuous denitration apparatus. Data are given on the electrical properties of annealed and quenched specimens of UO_2. Data are given on the effect of sulfur on the physical properties and corrosion resistance of stainless steel alloys exposed at 1700°F for 500 hr to an atmosphere of cracked NH_3 plus 40% water vapor. An effort is being made to find a salt composition more suitable for heat treating uranium than that currently in use. The resistance of commercial refractories to molten fluoride slags and to molten uranium is being investigated with a view to selecting a suitable material for lining a container to be used in the continuous reduction of UF_4. Data on bend strength of BeO compacts sintered in hydrogen at various temperatures are given. The bulk density of BeO compacts prepared from impure hydroxides is given. Thermal-cycling data are given for U-Zr alloys cycled between 150 and 680°C. Experiments are being carried out in boiled-deionized water to determine the mechanism of U corrosion. The solid-solid reaction between zirconium and uranium dioxide is being studied. The Th-rich end of the Th-U phase diagram is being studied by means of high-temperature x-ray diffraction. Air-oxidation rates are given for Nb-base alloys. Studies are being made of the reaction of U and U alloys with hydrogen. Elevated-temperature N_H values of hydrided Zr alloys are given. Physical properties of UO_2 compacts modified by pure or stabilized ZrO_2, silica, and ceria are presented. (W.L.H.)

11443 CRMet-753

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

EXAMINATION OF SINTERED ALUMINUM PRODUCT TUBES. W. Evans. Mar. 1958. 17p. (AECL-573). $0.50(AECL).

The metallographic examination of three samples of sintered aluminum product tubing, two of Swiss origin and one of Alcoa M257 material is reported. On annealing, the Swiss samples developed blisters. This is attributed to a high hydrogen content and its diffusion to an oxide rich zone located near the outer surface of the tubes. The Alcoa M257 sample did not blister on annealing, and its microstructure was found to be satisfactory. (auth)

11444 CRMet-766

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

THE EFFECT OF COLD WORK ON THE IRRADIATION STABILITY OF BETA HEAT TREATED URANIUM. W. R. Thomas. June 1958. 25p. (AECL-591). $1.00 (AECL).

The effect of cold work on the irradiation stability of beta heat treated uranium has been measured for amounts of cold work varying from 0.70% to 5.8%. Cold work was introduced into full length NRX rods by cold drawing through a circular die. It was found that the surface finish of the rods after drawing was excellent and that the rate of irradiation growth as a function of cold work can be expressed by the equation: Growth Rate in micro inches/in./Mwd/T = 5.9(% Reduction in Area) -2.4. The results are discussed with reference to the temperature distribution existing in an NRX rod at full power and it is concluded that the growth rate of the coolest portions of the rod determines the growth characteristics of the entire rod. (auth)

11445 DP-248

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

ELECTRON METALLOGRAPHY OF THE Al-Ni-U

BOND. Carl L. Angerman. Dec. 1957. 22p. Contract AT(07-2)-1. $0.75(OTS).

The diffusion zones formed during the bonding of nickel-plated uranium cores to aluminum sheaths were identified by correlating the appearance of these zones with those identified in diffusion couples. A relationship between the structure and the strength of the bond was observed. (auth)

11446 HW-49816

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

DEVELOPMENT OF A FUSION WELDING PROCESS FOR METAL JOINING IN A HIGH VACUUM. H. W. LeFevre, J. T. Russell, and W. L. Wyman. Apr. 25, 1957. 11p. $3.30(ph OTS); $2.40(mf OTS).

This process is suitable for welding Zr alloys and stainless steel alloys. This process offers the best means of sealing fuel elements in a high vacuum. No corrosion data have been obtained on welds made by this process. (W.L.H.)

11447 NAA-SR-2312

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

A HIGH-TEMPERATURE VACUUM QUENCH FURNACE. S. B. Austerman, G. M. Wolten, and C. T. Broman. June 15, 1958. 13p. Contract AT-11-1-GEN-8. $0.50 (OTS).

The design and operation of a furnace for heating and quenching refractory specimens in vacuo or controlled atmosphere are described. The tantalum heater tube is electrically heated and has a heating space about five inches long and 1⅜-inch diameter. The specimen can be dropped at will from the heated zone into a quenching cup. The furnace has been operated at temperatures as high as 2400°C. The electrical requirements at 2000°C are approximately 8.1 volts and 630 amperes. (auth)

11448 NMI-1192

Nuclear Metals, Inc., Cambridge, Mass.

THE EFFECT OF COPPER, NICKEL, IRON, AND CHROMIUM ON THE TENSILE PROPERTIES OF PREFERENTIALLY ORIENTED BERYLLIUM SHEET. F. M. Yans, A. D. Donaldson, and A. R. Kaufmann. Feb. 14, 1958. 40p. Contract AT(30-1)-1565. $1.25 (OTS).

Beryllium was mixed with copper, nickel, iron, and chromium to form binary alloys in powder form, then extruded and cross rolled. The effect of each alloying element was determined by tensile testing. In solid solution, small amounts of iron and nickel had an embrittling effect, while copper in solution increased the strength but had no effect on ductility. The effect of chromium was complicated and not readily explainable. The planes and modes of fracture were investigated. (auth)

11449 NP-6732

Brown Univ., Providence.

METALLOGRAPHIC STUDY OF THE DEFORMATION OF A PARTICLE STRENGTHENED ALLOY, WC –Co. Technical Report No. 1. J. Gurland. May 1958. 31p. Contract Nonr-562(19).

A metallographic investigation of the deformation in bending of a number of tungsten carbide–cobalt alloy compositions was carried out as part of a study of the mechanical behavior of aggregates of ductile and brittle constituents. It was found that the ductile failure of the cobalt-rich alloys is preceded by localized plastic flow of the matrix and by cracking of the carbide grains. The carbide-rich compositions failed in a brittle manner by catastrophic propagation of cracks through the carbide grains. (auth)

11450 NYO-7788

Aeroprojects, Inc., West Chester, Penna.

INVESTIGATION OF ULTRASONIC GRAIN REFINEMENT IN BERYLLIUM. N. Maropis and J. B. Jones. Feb. 1957. 96p. Contract AT(30-1)-1836. $2.50(OTS).

A controlled-atmosphere induction-heated furnace was devised to permit treatment of melted beryllium with ultrasonics. Operating procedures were developed and effectiveness of the equipment was established in a series of fourteen melts with several metals, including copper. Ultrasonic grain refinement was accomplished. A total of 25 beryllium melts were prepared, including four with additives of nickel, zirconium, silicon, and titanium. Ultrasonic treatment over a range of power and frequency did not reduce grain size below that reportedly accomplished by chill casting in any of the beryllium melts, including those with the additives. It was observed that nucleation in beryllium, with or without ultrasonics, was initiated essentially at external surfaces; there being little evidence of internal nucleation. Results are briefly evaluated on the basis of heterogeneous nucleation theory. (auth)

11451 NYO-8664

Hausner (Henry H.), New York.

PRELIMINARY REPORT ON THE METAL POWDER SLIP CASTING PROCESS. PART II. Henry H. Hausner. May 8, 1958. 13p. Contract AT(30-1)-2131. $3.30(ph OTS); $2.40(mf OTS).

The first part of this report concerns the various possibilities for movement of a powder particle in a liquid and shows that on account of this movement an improved particle packing system is achieved. The second part deals with the pH factor of the slip and the effect of this variable on the density of compacts, as-cast, dried, and as-sintered. The conclusion is drawn that the pH factor affects the density of the specimen in various stages of the process but probably does not contribute to the sinterability of the slip-cast compact. The third part concerns the strength and elongation of slip cast and sintered 316 stainless steel, and it is attempted to explain the high value for elongation with the grain structure of the material. (auth)

11452 ORNL-2494

Oak Ridge National Lab., Tenn.

PREPARATION OF METALLOGRAPHIC SPECIMENS THROUGH VIBRATORY POLISHING. E. L. Long, Jr. and R. J. Gray. June 26, 1958. 17p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

In principle, the art of preparing metallographic specimens with abrasives has not altered for more than 50 years. In 1956, vibratory polishing, which was then in its infancy, was introduced to the field of metallography. Since that time much effort has been expended toward the development of this new mode of polishing. Vibratory polishing has proved its worth in the metallography laboratory and has many inherent advantages that could be a real asset to remote metallographic facilities. (auth)

11453 SEP-247

Sylvania Electric Products Inc. Research Labs., Bayside, N. Y.

FUNDAMENTALS OF SINTERING—II. Second Annual Progress Report, June 30, 1956 to June 30, 1957. A. L. Pranatis, L. S. Castleman, and L. Seigle. Feb. 15, 1958. 32p. For Sylvania-Corning Nuclear Corp. Contract AT-30-1-GEN-366.

Rates of spheroidization and densification of gold and of nickel wire compacts were measured as a function of time, temperature, and wire size. The necks joining the sintered particles were found to grow proportionally to the one-fifth root of time. The value of the coefficient of self-diffusion calculated from the sintering rate is of the same order of magnitude as that obtained by ordinary tracer techniques but with a somewhat higher activation energy. These results are entirely consistent with those predicted by the Kuczynski diffusional theory of sintering, as is the effect of wire size on sintering rate. The experiments did not reveal a clear effect of grain boundaries on sintering rates. This may be due to a relatively slow densification of the nickel wire compacts at even 0.98 of the absolute melting point, which obscured the effect of grain growth on sintering rate. (auth)

11454 SRO-12

Horizons, Inc., Cleveland.

RESEARCH AND DEVELOPMENT IN THE FIELD OF THORIUM CHEMISTRY AND METALLURGY. VOLUME II. PILOT SCALE PRODUCTION OF THORIUM METAL BY FUSED SALT ELECTROLYSIS. Final Report. Lothar Abraham, Edward L. Thellmann, and James L. Wyatt. June 30, 1956. Decl. June 6, 1957. 261p. Contract AT(30-1)-1335. (HZ-99). $6.00(OTS).

Data on design development work incorporated in Volume II include information on small-scale cells which were the prototype forerunners for a large, 7,500 ampere pilot production unit. Additional data on an externally heated cell of 2,000 to 2,500 ampere capacity also are included, since this unit was the first one to try out a completely tight system with removal chambers and inert atmosphere control. Major emphasis, however, is placed on the design and operation of a Mark XXVI electrolytic cell, rated for semi-continuous operation at a level of 7,500 amperes. Two campaigns were run in the large cell, each producing 23 cathode deposits. Operating data and metal evaluations of productions resulting from these campaigns are presented in detail, together with a complete discussion of the operations, proposed design changes, yields, efficiencies, and other pertinent variables. A complete outline of the metal recovery process is presented, together with operating data and suggested modifications for large scale production facilities. Physical properties of electrolytically produced granular thorium metal are included in the latter portion of the report, data being presented which indicate the feasibility of producing a high quality thorium product by fused salt electrolysis and the desirability of utilizing powder metallurgy approaches for ultimate fabrication. Recommendations for additional work and possible large scale production also are included in this Volume. (auth)

11455 WAPD-PWR-PMM-1220

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]

OUTLINE OF PWR ALTERNATE CONTROL MATERIAL INFORMATION OBTAINED AT BETTIS. June 15, 1957. 42p. $7.80(ph OTS); $3.30(mf OTS).

Physical properties of the Ag–15 In–5 Cd alloy are listed. Tests after neutron irradiation indicate that the alloy has neutron absorption characteristics that equal hafnium and excell Ag–30 Cd. Corrosion of the alloy in high-temperature water, oxygenated, hydrogenated, and degassed, is studied. A comparison of hafnium and Ag–15 In–5 Cd is made. Dimensional changes in Cu–B_4C after irradiation are shown. (See also WAPD-PWR-PMM-1207.) (W.D.M.)

11456 AEC-tr-2944

METHOD OF RECORDING PURE COMPRESSION STRENGTH CURVES OF A METAL. G. E. Arkulis (Magnitogorsk G. I. Nosov Institute of Mining and Metallurgy). (Translation from Russian—source of original article unknown). [1955?]. 5p.

A device and method for measuring and plotting the true stress curve of a metal are described. The method, based on measurement with a constant cross section of specimen, obviates difficulties and sources of error found in other methods. (T.R.H.)

11457

CONTRIBUTION TO THE STUDY OF THE MECHANISM OF THE CORROSION OF MAGNESIUM AND ITS ALLOYS. Guy Bronoel. Compt. rend. 246, 2750-3(1958) May 12. (In French)

The mechanism of corrosion of high-purity magnesium and a magnesium alloy containing 3% aluminum, 1% zinc, and 0.02, 0.016, 0.012, and 0.0006% iron was studied. The potential/pH curves for electrodes of magnesium and this alloy in hydrochloric acid solutions were obtained. The experiments were made at 20, 30, 40, and 50°C in the presence of air or under a nitrogen atmosphere. Comparative measurements were made without agitation and after violent agitation of the solution in the region next to the electrode. The potential/pH curve shows the existence of four regions: the first shows an increase of potential where the electrode acts solely as a hydrogen electrode with the magnesium not entering the reaction; the second region shows the appearance of small germs of magnesium hydroxide; in the third region the surface of the electrode is covered with the hydroxide; the fourth region reveals a deepening of the layers of the magnesium hydroxide and the potential remains constant. The potential/pH curve for the alloy shows a much more complex film formation on the electrode. It is probable that hydroxides of aluminum and zinc are also formed. The alloy is more swiftly attacked than the high-purity magnesium. (J.S.R.)

11458

STUDY BY NEUTRON DIFFRACTION OF THE ALLOY $MnAu_2$. André Herpin, Pierre Mériel, and André P. Meyer. Compt. rend. 246, 3170-2(1958) June 2. (In French)

By neutron diffraction the crystalline structure of $MnAu_2$ was determined, and the results are tabulated. The magnetic structure of the metallic compound is complicated. (tr-auth)

11459

EFFECTS OF ALLOYING ON THE TEMPERATURE OF POLYMORPHOUS TRANSFORMATIONS OF METALS. O. S. Ivanov (Baikov Inst. of Metallurgy, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 119, 271-3(1958) Mar. 11. (In Russian)

A general regularity was observed in the effects produced by alloying elements on the polymorphous transformations in metals. These effects are qualified by the position of the stability areas of the various types of crystalline lattice in the periodic system and by the position of the polymorphous and alloying metals in it (by the number of electrons in the incomplete shell). (R.V.J.)

11460

RHENIUM RECRYSTALLIZATION DIAGRAM. E. M. Savitskii, M. A. Tylkina, and K. B. Povarova (Baikov Inst. of Metallurgy, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 119, 274-7(1958) Mar. 11. (In Russian)

The recrystallization temperature for cast rhenium

is lower than for the metallo-ceramic rhenium. The data show that rhenium does not have tendencies to sudden grain growth even at annealing temperatures as high as 2000 to 2400°. The grain diameters of rhenium deformed by various degrees of compression higher than critical do not exceed 15 to 20 μ for metallo-ceramic rhenium and 100 μ for cast rhenium. The high hardening property of rhenium calls for frequent intermediate annealing during cold treatment. The optical temperature for rhenium annealing with more than 10% deformation was found to be in the range of 1750 to 2400°. (R.V.J.)

11461

KINETICS OF THE OXIDE FILM FORMATION ON TUNGSTEN AND MOLYBDENUM. V. A. Arslambekov and K. M. Gorbunova (Inst. of Physics in Chemistry, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 119, 294-7(1958) Mar. 11. (In Russian)

Descriptions are given of the installation and the method for an accurate continuous analysis of the weight changes and oxidation processes in tungsten and molybdenum in a wide range of oxygen pressures and temperatures. (R.V.J.)

11462

MICROHETEROGENEITY CHANGES IN ALLOYS SUBJECTED TO HEAT TREATMENT. Z. A. Sviderskaya, M. E. Drits, and E. S. Kadaner (Baikov Inst. of Metallurgy, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 119, 311-13(1958) Mar. 11. (In Russian)

Characteristic changes in the microheterogeneity coefficients of Al–Fe, Al–Ca, Ca–Mg, and Al–Ca–Mg–Mn alloys with annealing time and temperature are presented graphically. (R.V.J.)

11463

REGULARITIES IN THE PLASTIC FLOW OF LEAD AND TIN UNDER CLEAN SHEAR. V. I. Likhtman and V. S. Ostrovskii. Doklady Akad. Nauk S.S.S.R. 119, 484-7(1958) Mar. 21. (In Russian)

Rheological properties of lead and tin under stress were studied. Diagrams showing the dependence of the rate of flow, plastic viscosity, and absorption on the applied tension are included. (R.V.J.)

11464

LINEAR EXPANSION COEFFICIENTS OF DILUTED α-SOLID SOLUTIONS OF Fe WITH Cr, Mo, AND W. Yu. G. Miller (Baikov Inst. of Metallurgy, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 119, 488-9(1958) Mar. 21. (In Russian)

Correlations were made of the influence of alloying admixtures of Cr, Mo, and W on the self-diffusion factor of α-Fe in diluted solid solutions and the influence of concentrations on the linear thermal expansion factors of the same alloys. (R.V.J.)

11465

AN INVESTIGATION OF THE PHASE COMPOSITION OF IRON–VANADIUM AND IRON–CHROMIUM ALLOYS. M. I. Zakharova, I. A. Ignatova, L. A. Semenova, and N. A. Khatanova (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 119, 498-500(1958) Mar. 21. (In Russian)

The phase compositions of iron–vanadium and chromium–iron alloys after thermal treatments at 1400 to 600°C followed by water quenching were studied. (R.V.J.)

11466

CREEP OF AUSTENITE STEEL UNDER COMPLEX STRESS. I. A. Oding and G. A. Tulyakov. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk No. 1, 3-10 (1958) Jan. (In Russian)

Results are presented from tests made on thin-walled metallic tubes with 0.09% Cr, 0.78% Mn, 0.36 Si, 0.010% S, 0.018% P, 17.18% Cr, 10.68% Ni, and 0.47% Ti at 600°C (with preliminary heat treatment at 1100°C and cooled in air) to determine the creep properties under torsion stress. The experiments did not confirm the theory of directional coincidence of principal tensions and principal axes in deformation under prolonged stress. Observations of creep under complex stress revealed the redistribution of the main creep velocities with the alignment of the creep velocities in the main directions v_1 and v_2 and the creep velocity in a third direction v_3 converging to zero. (R.V.J.)

11467

SIMULTANEOUS X-RAY AND MICROSTRUCTURE ANALYSIS OF DEFORMATION PROCESSES DURING HEAT TREATMENT OF METALS AND ALLOYS. M. B. Guterman, N. A. Dron, M. G. Loxinskii, and M. I. Teumin (Mechanical Inst., Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk No. 1, 11-20(1958) Jan. (In Russian)

Descriptions are given of the scheme and performance of the sharp-focusing x-ray tubes and the installation developed for the simultaneous micro- and x-ray diffraction analysis of metals and alloys during heat treatment. (R.V.J.)

11468

REGULARITIES IN THE DEPENDENCE OF SOLID SOLUTION CRYSTAL MICROHARDNESS ON THE COMPOSITION OF ALLOYS IN THREE COMPONENT SYSTEMS. N. N. Glagoleva and V. M. Glazov. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk No. 1, 130-4 (1958) Jan. (In Russian)

The microhardness dependence on the composition of the solid solution in the systems Al–Mg, Al–Si, Al–Mg–Si, Al–Cu, Al–Cu–Mg, Cu–Zn, Cu–Sn, and Cu–Zn–Sn was investigated. The effects of composition on microhardness in the ternary systems Al–Mg–Si, Al–Cu–Mg, Cu–Zn–Sn were studied on cross sections with 1:1 weight ratio between the alloyed components. Also studied were the relation of microhardness to the composition in transitions from one phase to two phase system. The cross sections and the composition of alloys are given at 550° for Al–Mg–Sn and at 500° for Cu–Zn–Sn. (R.V.J.)

11469

ATTEMPT TO PURIFY METALS BY ZONE MELTING WITH AN ARC. G. Cabane (Dept. de Métallurgie et de Chimie Appliquée, Paris). J. Nuclear Energy 6, 269-74(1958) May. (In French)

The most reactive metals can be melted without contamination by arc-melting on a water-cooled copper hearth. For the purification of these metals, the zone melting process was applied with an apparatus in which a zone of a metallic rod resting in the groove of a copper hearth is melted by a tungsten arc. Efficiency of arc zone melting was checked for uranium, zirconium, and thorium purification. Advantages and limitation of the process are outlined. (auth)

11470

VACUUM OVEN FOR METALLURGICAL STUDIES. M. T. Destribats (Centre d'Etudes Nucléaires, Saclay, France). Le Vide No. 68, 184-7(1957) Mar.-Apr. (In French)

The conversion of a laboratory oven with standard commercial elements to vacuum operation is described. (T.R.H.)

11471

ELECTRON METALLOGRAPHY OF THE U–Ni DIFFUSION ZONES. Presented at Nuclear Engineering and

Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 63, Session 9. C. L. Angerman (E. I. du Pont de Nemours and Co., Aiken, S. C.). New York, American Institute of Chemical Engineers, 1958. 15p.

The microstructures of the intermetallic compounds formed by diffusion in couples of wrought uranium and nickel, and in couples of wrought uranium and electrodeposited nickel were studied by electron metallography and x-ray diffraction. A total of seven intermetallic compounds were observed as predicted by the phase diagram. A layer of uranium dioxide present on the surface of the uranium was broken during the initial diffusion, coalesced with subsequent diffusion, and finally dissolved. (auth)

11472

MOLYBDENUM AND TUNGSTEN. POSSIBILITIES IN THE NUCLEAR FIELD. M. Davis (U.K.A.E.A., Industrial Group, Culcheth, Eng.). Nuclear Eng. 3, 243-6 (1958) June.

Molybdenum and tungsten have high-temperature and other properties which may make them attractive as canning materials for some types of advanced nuclear reactors. Exploitation in this field may first require the development of suitable alloys. The properties of the metals are discussed and tabulated. (auth)

11473

ALUMINIUM FABRICATION FOR NUCLEAR WORK. D. Slater (A.P.V. Co., Ltd.). Nuclear Eng. 3, 247-50 (1958) June.

Using shielded welding processes high-quality joints may be made in pure aluminum. Porosity can be considerably reduced by preheating techniques, and distortion problems can be satisfactorily solved. Little is known at present of the effect of porosity in fatigue conditions. Further effort may be required to improve the already high attainable weld quality, but few applications will be found where the present high standards would be unacceptable. (auth)

11474

ON THE TOTAL SUMMATION RULE FOR OSCILLATOR STRENGTHS OF ALKALI METALS. I. B. Bersuker (Beltskii State Pedagogical Inst.). Soviet Phys. (Doklady) 2, 167-9(1957) Mar.-Apr.

In the calculation of the oscillator strengths of alkali metals, the effect of the screening potential and the exchange operator resulting from the distortion of the "ϕ-cloud" of the internal electrons are neglected. The influence of the core on optical electron transition when perturbed by an electromagnetic wave can be allowed for in the calculations by introducing an additional periodic perturbation in the form of the potential energy of an optical electron in the field of the core wave which has been polarized noninertially by the outside wave field. The oscillator strengths for Na, K, and Ca were calculated by this method and compare favorably with experimental results. (J.S.R.)

11475

DYNAMICAL COMPRESSIBILITY AND EQUATION OF STATE FOR IRON UNDER HIGH PRESSURE. L. V. Altshuler, K. K. Krupnikov, B. N. Ledenev, V. I. Zhuchikhin, and M. I. Brazhnik. Zhur. Eksptl'. i Teoret. Fiz. 34, 874-85(1958) Apr. (In Russian)

Two methods for measurement of dynamical compressibility of substances are described which are based on determination of the kinematical parameters of shock waves, their velocity of propagation and the mass velocity of the substance behind the front. The adiabates of shock compressibility of iron possessing various initial densities were determined by these methods in the pressure range from 4×10^5 to 5×10^6 atm. The compressibility curve of iron at absolute zero temperature is derived from the experimental data obtained. The curve is extrapolated to pressures at which statistical models of the atom are valid. (tr-auth)

11476

DYNAMICAL COMPRESSIBILITY OF METALS UNDER PRESSURE FROM 400,000 TO 4 MILLION ATMOSPHERES. L. V. Altshuler, K. K. Krupnikov, and M. I. Brazhnik. Zhur. Eksptl'. i Teoret. Fiz. 34, 886-93 (1958) Apr. (In Russian)

A method for determination of pressures and densities of shock compression is proposed which is based on the measurement of the velocities of propagation of strong shock waves. The dynamical compressibility of copper, zinc, silver, cadmium, tin, gold, lead and bismuth have been measured by this method in the pressure range from 400,000 to 4,000,000 atm. The highest degrees of compression (2.26 and 2.28 times) were observed in lead and bismuth, that is, in elements with the highest atomic volumes. The highest absolute density (32.7 g/cm^3) was recorded in gold. (tr-auth)

Tracer Applications

11477

AGE OF METEORITES BY ISOTOPIC MEASUREMENT. Johannes Geiss (Physikalisches Institut der Universität Bern). Chimia (Switz.) 11, 349-63(1957) Dec.

The results of radioactive age determinations on meteorites by various methods are summarized. The significance of these figures for the history of meteoritic matter is discussed. It is pointed out that indications for the presence of normal gases in meteorites are found by several investigators. The significance of measurements on these gases, especially on their isotopic composition, is outlined. Special interest is given to the cosmic ray produced isotopes of gases, and the possibilities of obtaining radiation ages for meteorites are discussed. The only method used so far, which in principle gives precise radiation ages, consists in the measurement of the helium-3/hydrogen-3 ratio. For the Norton County achondrite this method has given a radiation age of 260 million years, compared with an A/K age of 4400 million years. The influence of short-time variations of the cosmic ray flux on the helium-3/hydrogen-3 age is discussed. The secular changes of the cosmic ray intensity may be investigated by the comparison of cosmic ray produced K^{40} and for instance Ar^{38} in iron meteorites. Argon contents of stone meteorites can be used to estimate radiation ages with sufficient precision in order to draw conclusions about the meaning of these ages. It is derived that the Ar^{38} contents imply radiation ages of chondrites of the order of 40 million years and of some achondrites of 10 to 20 million years. It is shown that these radiation ages are determining the moment of the creation of the meteorite by the break-up of a larger body. (auth)

11478

DISTRIBUTION OF HELIUM-3 IN THE CARBO METEORITE. E. L. Fireman (Smithsonian Astrophysical Observatory, Cambridge, Mass.). Nature 181, 1725 (1958) June 21.

The distribution of helium-3 was measured following neutron activation conversion to tritium in samples taken from sliced section from the Carbo meteorite, found in Mexico in 1923. Results were in good agreement with previous measurements on drilling taken from holes in the meteorite. The lack of argon-39 in

the meteorite indicates that it landed more than 1,500 years ago. Variations in helium-3 distribution are used as a basis for conclusions concerning the energy of the bombarding cosmic rays in space. (C.H.)

PHYSICS

11479 AD-137088
California Inst. of Tech., Pasadena. Guggenheim Jet Propulsion Center.
ON THE STATISTICAL DESCRIPTION OF SPRAYS. F. A. Williams. June 1958. 16p. Contract DA-04-495-Ord-446.

An analysis of sprays is given which describes a large class of physical processes and emphasizes the underlying assumptions involved in spray theory. The impingement atomization of sprays and the combustion of sprays in a one-dimensional chamber are treated in detail within the framework of this formalism. From the calculated size histories it is shown that more complete atomization and greater combustion efficiency are obtained when the initial droplets are uniform in size. (auth)

11480 AECU-3753
Michigan. Univ., Ann Arbor.
PRECISE VAPOR PRESSURE MEASUREMENT AT HIGH TEMPERATURE. Robert E. Machol and Edgar F. Westrum, Jr. [Nov. 1957]. 14p. [Project No. 5]. Contract [AT(11-1)-70]. (M-6404). $3.30(ph OTS); $2.40(mf OTS).

An apparatus using a silica Bourdon gage is described for the measurement of vapor pressures or dissociation pressures with an accuracy of 0.1 mm and 0.1°C up to maximum pressures of atmospheric or beyond and maximum temperatures of 850 to 1250°C. The method is applicable to corrosive substances, to substances whose vapor pressure is sensitive to slight changes in composition, and to substances difficult to purify of volatile contaminants which affect the vapor pressure. (auth)

11481 AERE-ED/R-1843
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
A HOMOPOLAR GENERATOR FOR HIGH CURRENT LOW VOLTAGE D.C. SUPPLY. D. A. Watt. Nov. 30, 1951. Decl. Jan. 17, 1956. 26p. $0.68(BIS).
Declassified version of AERE-CE/R-821.

A general theory of Homopolar Generator Design is given, including estimation of brush friction loss and conditions for stable operation when conducting large currents. A tabulated survey of the principal ohmic losses and power absorbed by brush friction is given for a 10kW generator. Three operating conditions are considered, ranging from 4,000 amps at 2.5 volts to 16,000 amps at 0.625 volts. Brush stability is examined and over-all merits of sodium-potassium alloy and mercury as the brush liquid are considered. It is shown that there are designs of 90 to 95% efficiency using mercury or alloy brushes, but mercury is to be preferred as it ensures greater brush stability under momentary overload and involves fewer development problems. A design of approximately 90% efficiency with mercury brushes is detailed. It has a rotor of radius 16 cms., length in gap 6 cms., and is run at 935 rpm with gap flux 10,700 gauss to give 10,000 amps at 1.0 volt and at 780 rpm, 8,000 gauss, to give 16,000 amps at 0.625 volt. (auth)

11482 AERE-EL/M-70
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE INTEGRATION OF CURRENTS FLOWING THROUGH AN ELECTROLYTIC CELL. E. H. Cooke-Yarborough. Mar. 4, 1952. Decl. May 21, 1958. 8p.

Methods of integrating the current flowing through an electrolytic cell are considered, and it is shown that serious errors may be introduced if the current falls off rapidly with time. Methods of minimizing these errors are presented and it is concluded that, if suitable precautions are taken, an accuracy better than 1% should be obtainable. (auth)

11483 BRL-988
Ballistic Research Labs., Aberdeen Proving Ground, Md.
AIR BLAST MEASUREMENTS ABOUT EXPLOSIVE CHARGES AT SIDE-ON AND NORMAL INCIDENCE. A. J. Hoffman and S. N. Mills, Jr. July 1956. 42p. DA Project Nos. 5B03-04-002 and 5B-05-016.

Measurements of air blast peak pressures, positive impulses, and positive durations for both side-on and normal incidence from bare 50/50 spherical pentolite charges are presented. The explosive weight ranged from ½ to 8 pounds, the scaled distance from 1.48 to 14.81 ft/lb$^{1/3}$. Results of two hundred and sixty-nine test firings are tabulated and presented graphically. A description is given of the piezoelectric gage developed to measure the blast in the normally incident waves. (auth)

11484 BRL-Memo-1132
Ballistic Research Labs., Aberdeen Proving Ground, Md.
GRAPHS FOR USE IN OBTAINING DESIRED MACH AND REYNOLDS NUMBERS IN A SHOCK TUBE. Robert J. Janus. Feb. 1958. 38p. DA Project No. 5B03-04-002.

High-yield nuclear weapons having blast waves of long duration have increased the interest in the drag loading on objects exposed to air blast. Drag loading is a function of several flow parameters, of which two of the most important are Mach number and Reynolds number. In order to investigate drag loading in a shock tube it is necessary to be able to produce flows having given Mach and Reynolds numbers. This can be done by selecting the proper expansion chamber pressure and shock overpressure. Graphs based on the Rankine-Hugoniot relations and Sutherland's equation provide a means of determining the shock strength and expansion chamber pressure necessary to produce a flow having given Mach and Reynolds numbers. This report presents graphs of Mach number and Reynolds number as functions of shock strength, and the change in Reynolds number as a function of temperature and shock strength. The use of the graphs is explained and examples are provided. (auth)

11485 CF-57-3-73
Oak Ridge National Lab., Tenn.
COMMENTS ON THE DETERMINATION OF THE PARTICLE SIZE DISTRIBUTION OF THORIUM OXIDE. G. E. Moore. Mar. 31, 1957. 16p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Factors affecting the results of thoria particle size distribution measurements by sedimentation procedures currently and recently employed are considered. The effects of thoria concentration, solvent, dispersant, thoria properties, and other factors are discussed. (auth)

11486 HW-53504

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

WHAT IS STATIC SWITCHING? A. A. Maupin, Jr. Nov. 12, 1957. 10p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

An industrial control system consists of sensing devices, decision-making devices, and power output devices. Relays have traditionally been used as the decision-making components. A complete line of magnetic amplifier type devices is now available for use to replace relays as a decision-making system. These static switching devices have no moving mechanical parts, are not sensitive to dust or atmospheric conditions, and require almost no maintenance. Control systems using static switching devices usually have a higher first cost than would be the case if relays were used. However, their long life and high reliability may result in lower cost over the long term. Static switching systems operate at very low power levels and require some form of output power devices such as magnetic amplifiers or output relays. (auth)

11487 NAA-SR-2551

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

BUBBLE FORMATION: A BIBLIOGRAPHY. M. Bloomfield, W. N. McElroy, and R. E. Skinner. June 30, 1958. 69p. Contract AT(11-1)-GEN-8. $2.00(OTS).

Bubble phenomena have been given a new meaning with their study in relation to the kinetic behavior of reactors. Prior to their study in relation to physics, the bulk of work on bubble phenomena concerned naval engineering problems of behavior in cavitation and water entry behavior. This bibliography is intended to fill the need of the reactor physicist as well as the naval engineer. An attempt has been made to include all available references on bubble phenomena and associated effects. A subject index has been purposely omitted. It is felt that the breakdown in content headings is sufficient to ascertain areas of interest. There will be overlapping of headings and to find all possible entries, a search through the headings may be desirable. To increase the usefulness of this bibliography the location of an abstract has been cited wherever possible following the reference. Classified reports are included; however, their titles contain no classified information. Sources used in compiling this bibliography are: Chemical Abstracts, Industrial Arts Index, Applied Mechanics Review, Nuclear Science Abstracts, the AEC Abstracts of Classified Literature, the AEC card catalogs available at Atomics International, and the bibliographic services of Armed Services Technical Information agency. (auth)

11488 NP-6775

Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

QUARTERLY PROGRESS REPORT NO. 49 [FOR] PERIOD ENDING APRIL 15, 1958. J. B. Wiesner, G. G. Harvey, and H. J. Zimmermann. 150p. Project 3-99-00-100. Contract DA36-039-sc-64637.

Measurement of diode characteristics of junctions in germanium at very low voltages has been carried out. The effect of a magnetic field and of a unidirectional heating current on thermionic emission from molybdenum has been measured. The frequency response of the Shelton electrometer has been extended by mechanical redesign of the input circuit. An internal disappearing-filament pyrometer was designed. An experiment designed to measure the cyclotron resonance of molecular and atomic ions in a hydrogen plasma is in progress. A system using a twin-T null network for measurement of the ionized plasma properties, the normalized change in measurement coil inductance and the normalized change in resistance, has been developed. The collision cross section and the energy loss of slow electrons in hydrogen were measured. Microwave measurements of electron temperatures in the presence of a static magnetic field were investigated. An optical method has been devised for measuring the relative change of electron energy or temperature of a changing plasma. The five elastic constants of zinc have been measured from 4.2 to 77.6°K by an ultrasonic pulse technique. One measurement on a ruby single crystal has yielded a spin-lattice relaxation time of 0.037 ± 0.005 sec. A potassium cobalticyanide crystal was used to give sufficient population inversion of a two-level system by the 180° pulse technique to exceed unity gain, and on one occasion sufficient gain was obtained to produce oscillation. The paramagnetic properties of chromium ions present as an impurity in Al_2O_3 were examined at microwave frequencies. A series of measurements of the spin-lattice relaxation time of F^{19} nuclei in lithium fluoride crystals was completed. The effect of temperature broadening and self-reversal of the hyperfine structure of the Hg 2537 resonance line was studied. An FM receiver that incorporates a dynamic trap for capturing the weaker of two cochannel signals has been built and tested. The first two of twelve lectures by Norbert Wiener on nonlinear problems in random theory are presented. In statistical communication theory the invariance property of correlation functions under nonlinear transformations, statistical errors in measurement on amplitude-distorted Gaussian signals, and uniqueness of first-order output distributions of linear systems by the moment method have been investigated. A dynamic analog speech synthesizer and a terminal analog nasal consonant synthesizer are described. Work on mechanical translation, communications biophysics, neurophysiology, and network synthesis is reported. The design problems of a Stark cell for microwave spectroscopy are described. (For preceding period see NP-6620.) (W.D.M.)

11489 NP-6781

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

STEADY STIMULATION AND QUENCHING OF PHOTOCONDUCTIVITY IN CADMIUM SULFIDE BY INFRARED RADIATION. Report No. 21/1-B. M. Bartenbach, B. Buras, H. Rzewuski, and Z. Tomczak. Apr. 1958. 11p.

The changes in the steady photocurrent produced by exciting light in CdS single crystals by simultaneous illumination with infrared radiation was investigated. Many authors have reported quenching of photoconductivity in CdS by infrared and some stimulation phenomena of a transient character. Steady stimulation was observed to occur when the photocurrent caused by light alone is small compared with the photocurrent caused by infrared alone. For some definite ratio of the light intensity to the infrared intensity, the illumination with infrared causes no change in the photocurrent. If the ratio is bigger than that mentioned the well known quenching phenomena occur. By using x-rays instead of the exciting light, similar stimulation and quenching phenomena were observed. These results can be explained using the model proposed by Rose which involves the creation of free holes by infrared radiation and assuming that the current caused by infrared radiation only is associated with holes. (auth)

11490 SCTM-176-58-(51)
Sandia Corp., Albuquerque, N. Mex.
A 48-PORT SCANNER VALVE SYSTEM FOR BLOW-DOWN WIND TUNNEL PRESSURE TESTS. Mahlon George Baker. May 26, 1958. 9p. Contract AT(29-1)-789. $1.80(ph OTS); $1.80(mf OTS).

A new pressure measuring system, which will handle up to 48 model pressures, was installed in the 12-in. transonic tunnel. This system consists of a Scanivalve, two 24-port cutoff valves, a pressure transducer, a strip chart recorder, and an electronic control unit. The 48 trapped model pressures are successively recorded on a strip chart recorder immediately after a 7-second test blow. This report describes the scanner system and the associated electronic control unit. (auth)

11491 AEC-tr-3294
THE ELECTRICAL RESISTANCE OF PALLADIUM WIRES CHARGED WITH HYDROGEN BETWEEN 160° AND 310°. Hans Brüning and Adolf Sieverts. Translated for Westinghouse Bettis Atomic Power Div. from Z. physik. Chem. (Leipzig) 163A, 409-11(1933). 33p.

The electric conductivity of palladium wires in an atmosphere of hydrogen was determined at test temperatures of 160 to 310°C and with hydrogen pressures up to 28 atm. The amount of hydrogen absorbed between 160 and 200°C was determined, and the structure of the hydrogen–palladium system was established. (auth)

11492 AERE-Lib/Trans-768
GENERATION OF A STREAM OF HYDROGEN ATOMS WITH UNIDIRECTIONAL NUCLEAR SPIN. G. Clausnitzer, R. Fleischmann, and H. Schopper. Translated by R. Franklin (U.K.A.E.A., Atomic Energy Research Establishment) from Z. Physik 144, 336-42(1956). 9p.

By splitting up an H atom stream in a quadrupole magnetic field and separating one of the 4 components, H atoms with unidirectional nuclear spin are obtained. The field strength produced by the quadrupole field in the region of the atom stream is negligibly small, but the field gradient, on the other hand, is not small. Contrary to the Stern-Gerlach experiment the atoms are in so weak a magnetic field that nuclear spin and orbital electron spin are still coupled. With the non-focussing method of separation used here, the four hyperfine-structure components are, even without monochromatization, separated so far that one of them can be chosen with a mechanical screen. Through subsequent ionization of the H atoms it should be possible to obtain polarized protons. (auth)

11493
EQUATIONS OF STATE FOR LIQUID HELIUM. G. Borelius (Royal Inst. of Tech., Stockholm). Arkiv Fysik 13, 369-78(1958).

The consequences of a treatment of liquid He^4 I and He^3 as condensed highly degenerate states of a Fermi gas are discussed. The results are in both cases remarkably positive, which is surprising as He^4 with zero resulting spin is not expected to obey the Fermi statistics in the usual state of gas. (A.C.)

11494
INVESTIGATION ON RADIOACTIVE FALL-OUT AND THE ACTIVITY OF THE AIR. (IV). Walther Gerlach and Klaus Stierstadt. Atomkern-Energie 3, 222-7 (1958) June. (In German)

The results of the measurements of the radioactive fall-out in southern Bavaria in the second half of 1957 are presented. (J.S.R.)

11495
NUCLEAR PHYSICS MEASURING METHODS. III. MEASUREMENT OF THE NUCLEAR MOMENTS. Werner Braunbek. Atomkern-Energie 3, 236-8(1958) June. (In German)

Methods of measuring the mechanical, magnetic, and electric quadrupole moments of atomic nuclei are discussed. (J.S.R.)

11496
ULTRASONIC ATTENUATION IN SUPERCONDUCTING ALUMINUM. K. L. Chopra and T. S. Hutchison (Royal Military Coll. of Canada, Kingston, Ontario, Can.). Can. J. Phys. 36, 805-6(1958) June.

Measurements of the attenuation of 20-Mc longitudinal waves in normal, superconducting, and intermediate states of polycrystalline aluminum are reported. (W.D.M.)

11497
EFFECT OF THICKNESS ON THE RESISTANCE AND THE THERMOELECTRIC CAPACITY OF THIN LAYERS OF COBALT. France Savornin. Compt. rend. 246, 2866-9(1958) May 19. (In French)

Thin layers of cobalt were prepared by thermal evaporation in vacuum on glass backing at room temperature or at 175°C. The resistance was measured at room temperature as a function of the thickness of the cobalt film, and it was found that the resistance decreases when the thickness increases and is stabilized at a film thickness of about 200 to 300 A. The thermoelectric capacity varies with the thickness, increasing with the thickness and passing through a maximum. (J.S.R.)

11498
THE FOCUSING OF BEAMS OF CHARGED PARTICLES BY HIGH-FREQUENCY FIELDS. M. A. Miller (Lobachevskii Gor'kii State Univ.). Doklady Akad. Nauk S.S.S.R. 119, 478-80(1958) Mar. 21. (In Russian)

The focusing of rectilinear beams of charged particles effected by fast alternating electromagnetic fields of given structures is mathematically analyzed. (R.V.J.)

11499
ROLE OF SEMI-CONDUCTORS IN NUCLEAR PHYSICS AND ELECTRONICS. P. Gutmann and L. Koch (C.E.N., Saclay, France). Ind. Atom. 2, No. 5-6, 101-8(1958). (In French)

Semiconductors are discussed with respect to their characteristic properties, radiation effects, applications in nuclear physics, and applications in nuclear electronics. (T.R.H.)

11500
MASS SPECTROMETER MEASUREMENTS OF THE DIFFUSION COEFFICIENT OF HYDROGEN IN STEEL IN THE TEMPERATURE RANGE OF 25° - 90°C. Robert C. Frank, Don E. Swets, and David L. Fry (General Motors Corp., Detroit 2, Mich.). J. Appl. Phys. 29, 892-8(1958) June.

The diffusion coefficients for hydrogen in mild steel were measured in the temperature range of 25 to 90°C. A mass spectrometer was used to study the movement of hydrogen through thin steel plates. Two methods of measuring diffusion were used; the rate of approach to equilibrium when hydrogen is supplied to the plate, and the rate of outgassing when the source of hydrogen is removed. Two decidedly different sets of diffusion coefficients were obtained by the two methods. The first method gave diffusion coefficients which agree very well with values obtained by others at higher temperatures while the outgassing method, which was more

reproducible, gave values considerably lower. These results are compared with those of other investigators. (auth)

11501

RATIO OF THE DIFFUSION COEFFICIENTS FOR THE DIFFUSION OF HYDROGEN AND DEUTERIUM IN STEEL. Robert C. Frank, Robert W. Lee, and Robert L. Williams (General Motors Corp., Detroit 2, Mich.). J. Appl. Phys. 29, 898-900(1958) June.

The ratio of the diffusion coefficients for hydrogen and deuterium in steel were measured in the temperature range of 26 to 86°C. A mixture of the two gases was introduced into the steel by abrasion in a mixture of normal and heavy water. The diffusion coefficients were measured simultaneously for the two using the mass spectrometer to observe the rate of evolution of the gases from the steel. The ratio of the diffusion coefficients was found to be constant within the limits of experimental error over the entire temperature range and had a value of 1.37 ± 0.02. The ratio of the permeation rates was found to vary with the temperature. The results are compared with those of other investigators. (auth)

11502

ELECTRICAL CONTACTS TO SILICON CARBIDE. R. N. Hall (General Electric Research Lab., Schenectady, N. Y.). J. Appl. Phys. 29, 914-17(1958) June.

Rectifying junctions may be made by heating silicon–aluminum or silicon–boron alloys in contact with n-type silicon carbide. The measured solubility of carbon in liquid silicon is consistent with the view that these junctions are produced by an alloying and regrowth mechanism. Nonrectifying contacts may be made in an analogous manner using silicon-phosphorous alloys. Visible radiation is emitted uniformly over the rectifying junctions when current is passed in the forward direction, with a quantum efficiency of the order of 10^{-4}. Current flow in the reverse direction is associated with the appearance of "blue spots," similar in appearance to the points of light that are often observed when silicon junctions are biased in the avalanche region. (auth)

11503

HEAT CAPACITY OF COPPER–GERMANIUM ALLOYS BELOW 4.2°K. John A. Rayne (Westinghouse Research Labs., Pittsburgh). Phys. Rev. 110, 606-11(1958) May 1.

Heat capacity measurements below 4.2°K have been made on a series of alloys in the primary phase of the copper–germanium system. When corrected for lattice expansion, the resulting change in the electronic specific heat for low electron/atom ratios is found to be the same as that for the copper–zinc system. In neither case is the variation consistent with that expected for a parabolic valence band, thereby lending support to the previously advanced hypothesis that the Fermi surface in copper departs appreciably from sphericity. Both systems exhibit the same variation of Debye temperature with electron concentration, when appropriate corrections are made for the differences in the atomic mass and volume of the two alloy series. This supports the idea that the variation of the elastic constants in these alloys is influenced principally by the proximity of the Fermi surface to the boundaries of the first Brillouin zone. The variation of elastic constants with solute concentration, as deduced from the present work, is compared with that obtained from ultrasonic pulse measurements at room temperature. (auth)

11504

NEUTRON DIFFRACTION STUDY OF THE MAGNETIC PROPERTIES OF $MnBr_2$. E. O. Wollan, W. C. Koehler, and M. K. Wilkinson (Oak Ridge National Lab., Tenn.). Phys. Rev. 110, 638-46(1958) May 1.

The antiferromagnetic structure of $MnBr_2$ ($T_N = 2.16$°K) has been determined by single-crystal neutron diffraction measurements at temperatures down to 1.35°K and with magnetic fields (0–13 kilo-oersteds) applied to the sample. The antiferromagnetic structure appeared to have hexagonal symmetry in the absence of a magnetic field but this was found to be associated with a structure domain-growth property. The true magnetic structure was found to be associated with one or another of three hexagonal axes, the particular growth direction being determined by the direction of an applied magnetic field. Information relating to indirect magnetic exchange via the bromine ions in this crystal was obtained from a study of the domain growth properties. The antiferromagnetic ordering transition in this compound was found to be nearly first order rather than of the usual second order type. A small lowering (~2%) of T_N was observed for an applied field of 13.1 kilo-oersteds. Short-range order data were obtained from powder patterns. (auth)

11505

EASILY MOUNTED ALUMINIUM OXIDE FOILS FOR WINDOWS AND BACKINGS. Ulrich Hauser and Werner Kerler (Univ. of Heidelberg, Germany). Rev. Sci. Instr. 29, 380-2(1958) May.

The well-known difficulties with preparation, handling, and mounting of thin foils are avoided by the use of aluminum oxide foils (25 to 250 $\mu g/cm^2$, or 700 to 7000 A thickness) which are grown on a solid piece of mechanically shaped aluminum that serves also as the necessary robust frame. These foils have excellent properties for an application in the spectroscopy of particle and quantum radiation. A simple method for the mechanical and chemical preparation is described. The foils are gas tight, smooth, and withstand a considerable pressure. A formula describes the relation between breaking pressure, diameter, and thickness for circular shaped foils. (auth)

11506

PHOTOLUMINESCENCE OF THALLOUS CHLORIDE. A. S. Vysochanskii. Soviet Phys. (Doklady) 2, 20-3 (1957) Jan.-Feb.

The luminescence, absorption spectrum, luminescence excitation spectrum, and the temperature dependence of the luminescence spectrum of thallous chloride were studied. The original materials used in preparing thallous chloride were the triply recrystallized, chemically pure salts $TlNO_3$ and NH_4Cl or KCl. All operations were performed in darkness or dark red light. For investigation of the absorption spectrum, the samples were thin films deposited on a quartz backing. The excitation and luminescence spectra were studied in powdered phosphors, fused films, sublimated phosphors, and solidified melts. The absorption spectrum was investigated from 2200 to 4600 A, and three peaks were observed: the intrinsic absorption peak at 2490 A and two absorption peaks at 3520 and 3800 A. Peaks of the luminescence excitation spectrum were observed near 3520 and 3800 A. The luminescence spectra of thallous chloride phosphors have two luminescence bands: a blue band with a peak at about 4650 A and a red band with a peak near 6300 A. An investigation of the temperature dependence showed that the optimum temperature for the blue band was at −160° and for the red band

it was at −145°. It was concluded that thallous chloride is a typical crystalline phosphor in which the role of activator is played by excess thallium atoms which are absorption centers of exciting light as well as luminescence centers. Absorption results in an internal photoelectric effect and luminescence is preceded by the recombination of an electron in the conduction band with an excess thallium ion. (J.S.R.)

11507
ON THE SPONTANEOUS EMISSION OF A PARAMAGNETIC IN A MAGNETIC FIELD. V. M. Fain (Gor'kii Inst of Radiophysics). Zhur. Eksptl'. i Teoret. Fiz. 34, 1032-3(1958) Apr. (In Russian)

11508
OSCILLATION OF ELECTRICAL RESISTANCE IN n-TYPE GERMANIUM IN STRONG PULSED MAGNETIC FIELDS. I. G. Fakidov and E. A. Zavadskii (Inst. of Physics of Metals, Ural Branch of Acadeny of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 1036-7(1958) Apr. (In Russian)

Studies were made of the electrical resistance in several specimens of n-type germanium monocrystals in transverse pulsed magnetic fields with intensities up to 120 k gauss, at temperatures of 300, 77, and 20°K. (R.V.J.)

Aerosols

11509 USNRDL-TR-229
Naval Radiological Defense Lab., San Francisco.
A TECHNIQUE FOR THE RADIOAUTOGRAPHY OF ALPHA-ACTIVE AEROSOL PARTICLES ON MILLIPORE FILTERS. J. T. Quan. May 1, 1958. 17p.

Alpha-emitting aerosol particles collected on millipore filters are radioautographed and permanently mounted in close alignment with their tracks. The millipore filter is rendered transparent. Observation by microscope of particles and tracks in two different focal planes permits direct correlation of particle sizes, shapes and, to some extent, relative radioactivities. (auth)

11510
MEASUREMENT OF THE RADIOACTIVITY OF ATOMIC ORIGIN IN THE AIR AND ITS PRECIPITATIONS. Hubert Garrigue. Compt. rend. 246, 3089-91(1958) May 28. (In French)

A series of measurements, made from April 1957 to May 1958, show a recent increase of radioactive contamination. The powders resulting from the dryness following radioactive rains make the air near the ground very contaminated. (tr-auth)

11511
A THEORY OF THE INTERACTION BETWEEN EVAPORATING OR GROWING DROPLETS AT LARGE DISTANCES. S. S. Dukhin and B. V. Deriagin. Soviet Phys. (Doklady) 2, 41-4(1957) Jan.-Feb.

In an isothermal study of the problem of droplet motion in a diffusion field, equations for the diffusion force were obtained. The effect of the heat transfer, which occurs at the same time as diffusion, was considered in the derivation of the diffusion force formulas. (J.S.R.)

Cosmic Radiation

Refer also to abstract 11596.

11512 TT-744
ABSORPTION ANALYSIS OF THE STAR-PRODUCING COMPONENTS OF COSMIC RAYS. [PART I]. (Absorptionsanalyse der Sternauslösenden Komponenten der Ultrastrahlung.) E. Schopper, K. H. Höcker, and E. Rössle. Translated by D. A. Sinclair from Z. Naturforsch. 6a, 603-13(1951). 29p.

Parts II and III have been translated and produced as TT-745 and TT-746.

This paper was previously abstracted from the original language and appears in NSA, Vol. 6, as abstract No. 2405.

11513 TT-746
ABSORPTION ANALYSIS OF THE STAR-PRODUCING COMPONENTS OF COSMIC RAYS. III. SCINTILLATION COUNTER MEASUREMENTS. (Absorptionsanalyse der Sternauslösenden Komponenten der Ultrastrahlung. III. Szintillationszähler-Messungen.) G. Kuhn and E. Schopper. Translated by D. A. Sinclair (National Research Council of Canada) from Z. Naturforsch. 9a, 851-5(1954). 14p.

Transition curves are measured in solid absorbers with an arrangement of scintillation counters using an NaI phosphor of 40 mm diameter and 20 mm height for various discrimination levels of the ionizing events in the phosphor. The transition curves in lead, iron, and carbon absorbers in every case show two maxima, as has been observed with photographic plates. (auth)

11514
STUDY OF THE NUCLEAR COMPONENT OF COSMIC RADIATION REGISTERED IN EMULSIONS MAINTAINING A FIXED ORIENTATION IN RELATION TO THE SOLAR SYSTEM. Simone Desprez. Ann. phys. 3, 230-57(1958) Mar.-Apr. (In French)

An apparatus designed to study the spatial distribution of the nuclear component of cosmic radiation is described. It records in an emulsion which has a fixed orientation with respect to the sun. The apparatus was used to study an anisotropy which could be connected with a particle emission by the sun or give evidence of a diminution in intensity with time which could be due to a modulation by solar phenomena. The study was limited to particles below 160 Mev (proton). The results are tabulated and discussed, with respect to the origin of cosmic radiation. (T.R.H.)

11515
THE COSMIC RAY PHOTON AND π^0-MESON ENERGY SPECTRA AT 29-30 km ABOVE SEA-LEVEL. Gustav Svensson. Arkiv Fysik 13, 347-68(1958).

The photon spectrum at 29 to 30 km above sea level and 64° to 65° geomagnetic latitude has been determined by means of the nuclear emulsion technique, the multiple scattering of the electron pairs, produced when the photons materialize in the emulsion, being measured. Distortion, noise, energy loss of the electrons, outscattering, and materialization probability have been taken into account. The relation between the registered photon spectrum and the π^0-meson spectrum has been studied. The exponent obtained for the differential energy spectrum of the π^0 mesons is 1.5 ± 0.2 in the total energy interval from 0.25 to 3 Bev and 2.8 ± 0.4 for energies greater than 3 Bev. The last exponent may suffer from systematic errors due to distortion, spurious scattering, and scanning efficiency, which are difficult to estimate. (auth)

11516
ARGON-POTASSIUM AGES AND THE ISOTOPIC COMPOSITION OF ARGON FROM METEORITES. Johannes Geiss (Univ. of Chicago) and David C. Hess (Argonne National Lab., Lemont, Ill.). Astrophys. J. 127, No. 1, 224-36(1958) Jan.

The potassium and argon contents of 13 meteorites were measured by the isotopic dilution method. It is proved that the amounts of Ar^{36} and Ar^{38} found are of extra-terrestrial origin, the main source being spallation processes induced by cosmic radiation. In some chondrites an excess of Ar^{36} compared to Ar^{38} was found. Possible sources for this Ar^{36} are discussed. The 7 chondrites measured give ages between 4.4×10^9 and 4.0×10^9 years. The ages of achondrites vary be- 4.4×10^9 and 0.7×10^9 years. (auth)

11517

RAPID DECREASE OF COSMIC-RAY INTENSITY. R. A. R. Palmeira and R. W. Williams (Massachusetts Inst. of Tech., Cambridge). Nuovo cimento (10) 8, 352-5(1958) Apr. 16.

A remarkable sudden decrease in cosmic ray μ-meson intensity occurring in connection with the magnetic storm and auroral display of February 10, 1958 was investigated using a high-counting-rate, high time-resolution meson monitor employing large disks of plastic scintillator. The unit consists of three telescopes each of which counts coincidences between two layers of the plastic disks. A theoretical explanation for the phenomenon is sought. (T.R.H.)

11518

ABUNDANCE OF LIGHT NUCLEI IN THE PRIMARY COSMIC RADIATION. M. V. K. Appa Rao, S. Biswas, R. R. Daniel, K. A. Neelakantan, and B. Peters (Tata Inst. of Fundamental Research, Bombay). Phys. Rev. 110, 751-65(1958) May 1.

The composition of the primary cosmic radiation is modified as a result of nuclear collisions which particles suffer in transit through the interstellar medium. The most sensitive indicator for the frequency of such collisions is the number of nuclear fragments corresponding to lithium, beryllium, and boron, which are found in the incident radiation close to the top of the atmosphere. It is, however, difficult to determine what fraction of these particles originated in outer space and what fraction is due to additional nuclear collisions in the uppermost layers of the atmosphere above the point of observation. In order to determine the relative importance of these two components, the percentage of light elements in the primary cosmic radiation was measured as a function of the amount of air traversed by the particles. Measurements are based on an analysis of 651 particle tracks recorded at geomagnetic latitude $\lambda = 41°$. The relative intensities obtained under air masses varying from 8.5 to 30 g/cm^2 are in good agreement with individual values for vertically incident particles obtained by other workers. Data were obtained at a rather great altitude (6.6 g/cm^2 of residual pressure), so that they permit an extrapolation to the top of the atmosphere which is largely independent of assumptions regarding the collision cross sections and fragmentation probabilities of complex nuclei. The following primary flux values, in particles/m^2 sec sterad, were obtained:

Li, Be, B (L nuclei)		0.55 ± 0.60
C	2.65 ± 0.40	
N	1.90 ± 0.35	
O + F	3.00 ± 0.45	
C, N, O, F (M nuclei)		7.55 ± 0.65
$Z \geq 10$ (H nuclei)		2.20 ± 0.35

Thus Li, Be, and B nuclei represent but a small fraction of the flux of heavy primary particles. In order to account for this composition, the amount of interstellar gas traversed by the particles since their initial acceleration cannot have exceeded 1 g/cm^2 of hydrogen, as will be shown in detail in a separate paper. The smallness of this value imposes very stringent conditions on acceptable theories for the acceleration and subsequent diffusion of cosmic-ray particles. (auth)

11519

A STUDY OF THE EXPLOSIVE SHOWERS PRODUCED BY HIGH-ENERGY COSMIC RAYS. V. V. Alpers, I. I. Gurevich, V. M. Kutukova, A. P. Mishakova, B. A. Nikol'skii, and L. V. Surkova. Soviet Phys. (Doklady) 2, 1-3(1957) Jan.-Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 6429.

11520

THE ANGULAR AND LATERAL DISTRIBUTION FUNCTIONS OF PARTICLES IN A CASCADE SHOWER MAXIMUM. V. V. Guzhavin and I. P. Ivanenko (M. V. Lomonosov Moscow State Univ.). Soviet Phys. (Doklady) 2, 131-4(1957) Mar.-Apr.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 9356.

11521

NUCLEAR INTERACTION IN A PHOTOGRAPHIC EMULSION ACCOMPANIED BY A LARGE TRANSFER OF ENERGY TO THE ELECTRON-PHOTON COMPONENT. G. B. Zhdanov, E. A. Zemchalova, M. I. Tretyakova, and M. N. Shcherbakova (Lebedev Inst. of Physics, Academy of Sciences, USSR.). Zhur. Eksptl'. i Teoret. Fiz. 34, 843-8(1958) Apr. (In Russian)

A nuclear interaction event in which the primary energy was 250^{+250}_{-125} Bev and about 200 Bev was carried away by one of the π^0 mesons is investigated. The lower limit of the energy going over to the soft component is approximately 30% of the total shower energy. (tr-auth)

11522

ON THE RELATION BETWEEN THE ANGULAR AND ENERGY DISTRIBUTIONS OF PARTICLES EMITTED IN HIGH ENERGY NUCLEAR INTERACTIONS. G. B. Zhdanov (Lebedev Inst. of Physics, Academy of Sciences, USSR.). Zhur. Eksptl'. i Teoret. Fiz. 34, 856-61(1958) Apr. (In Russian)

Various experimental data on the magnitude of the transverse component of the momentum of particles created in high energy nuclear interactions are considered. The data are compared with the one-dimensional hydrodynamical theory of multiple particle production. (tr-auth)

11523

ON THE SPATIAL DISTRIBUTION OF PARTICLES IN EXTENSIVE ATMOSPHERIC SHOWERS. G. B. Khristiansen (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 34, 956-61(1958) Apr. (In Russian)

The relative role of various factors affecting the spatial divergence of charged particles in extensive air showers is considered. It is shown that the spatial distribution of electrons is completely determined by Coulomb scattering. The spatial distribution of μ-mesons is to a large degree determined by Coulomb scattering and deflection in the magnetic field of the earth. The transverse momentum transferred to π- and K-mesons in an elementary nuclear cascade act is respectively $\leq 1.5 \cdot 10^8$ ev/c and $\leq 5 \cdot 10^8$ ev/c. (R.V.J.)

11524

POLARIZATION OF μ MESONS IN COSMIC RAYS. I. L. Gol'dman (Inst. of Physics, Academy of Sciences, Armenian SSR.). Zhur. Eksptl'. i Teoret. Fiz. 34, 1017-19(1958) Apr. (In Russian)

The polarization of μ mesons in cosmic rays was calculated with the assumption that in a single decay action the polarization is complete. The analysis of depolarization shows that it is proportional to the atomic number of the substance, about 1% in air. Polarization after stopping depends on the chemical properties of the substance and can be evaluated using data on the asymmetry of $\pi-\mu-e$ decays. (R.V.J.)

Crystallography and Crystal Structure

11525 AEC-tr-3265

EXTRAPOLATION METHODS FOR POWDER DIAGRAMS OF NON-CUBIC CRYSTALS. [Extrapolations Methods für Pulveraufnahmen von Nichtkubischen Kristallen.] Hermann Weyerer. Translated for Sandia Corp. from Z. Krist. 109, 354-66(1957). 16p.

As an extension of the work on cubic crystals a graphical extrapolation method for the evaluation of non-cubic powder diagrams is described. The essential point of the new method is that each lattice parameter is determined from only those reflections for which the influence of the other parameters is very small. By means of further graphical or analytical refinement of this method it is possible to reach the same accuracy as in the cubic case, provided a sufficient number of reflections is available. (auth)

11526

CYCLOTRON RESONANCE IN FILMS. E. A. Kaner (Research Inst. of Radiophysics and Electronics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 119, 471-4(1958) Mar. 21. (In Russian)

Formulas were developed for the current and surface impedance of monocrystalline metal films under conditions of strongly anomalous skin effect. (R.V.J.)

11527

MOVEMENT OF DISLOCATION LOOPS IN LITHIUM FLUORIDE. S. Amelinckx and W. Dekeyser (Laboratorium voor Kristalkunde, Ghent, Belgium). J. Appl. Phys. 29, 1000-1(1958) June.

Very refined experiments on the movement of single dislocation loops in lithium fluoride crystals, as revealed by etch pits, have been reported. In this note a somewhat more detailed interpretation is given for one particularly significant experiment. (W.D.M.)

11528

X-RAY DIFFRACTION STUDIES OF PILE-IRRADIATED HAFNIUM HYDRIDES. S. S. Sidhu, F. P. Campos, and D. D. Zauberis (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 3, 778-80(1958) June.

After exposure to pile thermal and epi-cadmium neutrons and gamma rays for one month at 45°C, x-ray-diffraction patterns showed no apparent change in the crystalline structure or color of $HfD_{1.63}$, HfH_2, and $HfH_{1.8}$. (W.D.M.)

11529

DENSITY AND HARDNESS CHANGES PRODUCED BY PLASTIC DEFORMATION IN KCl CRYSTALS. W. H. Vaughan, W. J. Leivo, and R. Smoluchowski (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 110, 652-7 (1958) May 1.

A study has been made of the density changes which accompany plastic deformation in compression of potassium chloride crystals and of their annealing. Also hardness changes, their annealing, and slip-line formation have been investigated. Up to about 11% deformation, the slip is predominantly simple with some admixture of double slip, and no change of density is observed. At 11% deformation, multiple slip presumably sets in accompanied by a rapid decrease of density. The rate of formation of vacancies is 3.02×10^{17} cm^{-3} per percent deformation. A comparison of this value with the results of the experiments of Ueta and Känzig leads to the ratio of about four vacancies per electron trap. Vacancies seem to have no measurable influence on hardness which thus appears to be primarily associated with changes in the dislocation density or their configuration during plastic deformation. (auth)

11530

STRUCTURE OF THE α AND β FORMS OF SOLID He^3. A. F. Schuch, E. R. Grilly, and R. L. Mills (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 110, 775(1958) May 1.

Two solid forms of He^3, designated α and β, were recently reported to exist below and above, respectively, a transition line which intersects the melting curve at 3.15°K and 141 kg/cm^2. The nature of this transition was investigated by x-ray-diffraction methods. The Laue reflections of the α form of He^3 were indexed on the basis of a cubic lattice. The observed reflections were of the forms of {110}, {200}, and {121}. The β form was found to have the hexagonal close-packed structure. The Laue reflections that were obtained were of the form of {100}, {002}, {101}, {102}, {103}, {110}, and {112}. (A.C.)

11531

POSSIBLE EXPLANATION FOR MOSAIC-LIKE BRAGG REFLECTION IN QUARTZ UNDER STRAIN. Dwight W. Berreman (Univ. of Oregon, Eugene). Phys. Rev. 110, 992-3(1958) May 15.

A quartz crystal under strain tends to reflect x rays as if the crystal were of mosiac structure, while it becomes very nearly ideally perfect when the strain is small. This effect may be due to some sort of reversible dislocations in the crystal. The reversibility of any such dislocations would have to be such as to allow for the extremely perfect elasticity of quartz in all types of strain from static flexure to ultrahigh-frequency oscillations. (W.D.M.)

11532

ON CRYSTALLIZATION IN STATISTICAL PHYSICS. E. A. Arinshtein. Soviet Phys. (Doklady) 2, 54-9(1957) Jan.-Feb.

Crystallization is investigated by the method of N. N. Bogoliubov which permits the relation of thermodynamical functions to structure. (J.S.R.)

11533

STRUCTURE OF SUPERCONDUCTORS. XII. INVESTIGATION OF BISMUTH-RUBIDIUM ALLOYS. N. N. Zhuravlev, T. A. Mingazin, and G. S. Zhdanov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 34, 820-6 (1958) Apr. (In Russian)

A provisional melting diagram of the Bi—Rb system is constructed on basis of thermal, microscopic and roentgenographic data. Four compounds were established. These are Bi_2Rb, $BiRb_3$, Bi_2Rb_3, and $BiRb_2$. The superconducting compound Bi_2Rb crystallizes in the cubical system with a = 9.609 A and possesses the Cu_2Mg type structure. (R.V.J.)

11534

STRUCTURE OF SUPERCONDUCTORS. XIII. INVESTIGATION OF BISMUTH-CESIUM ALLOYS. N. N. Zhuravlev (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 34, 827-9(1958) Apr. (In Russian)

A provisional melting diagram of the Bi—Cs system is constructed. Three compounds Bi_2Cs, $BiCs_3$, and one which probably is $BiCs_2$ were found. The superconduct-

ing compound Bi_2Cs crystallizes in the cubical system with a lattice constant a = 9.746 ± 0.005 A and is isomorphic to the superconducting compounds Bi_2K and Bi_2Rb. (tr-auth)

11535

EFFECT OF CRYSTAL LATTICE VIBRATIONS ON ELECTRON-HOLE PAIR PRODUCTION IN A STRONG ELECTRIC FIELD. L. V. Keldysh (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 962-8(1958) Apr. (In Russian)

The probability for electron-hole production in a semiconductor located in a strong electric field is calculated with account of the interaction between the electrons and phonons. A temperature dependence of the effect is obtained which is very appreciable at low temperatures. A qualitative study is made of other processes which may influence the probability of a valency electron leaking into the conductivity zone. These processes are absorption of several phonons, collisions with a slow (nonionizing) conductivity electron, or an impurity. It is pointed out that the first of these processes may be decisive in relatively weak fields. (tr-auth)

Electrical Discharge

11536 AERE-T/M-158

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A NOTE ON THE STABILISED PINCH. R. J. Taylor. Feb. 1958. 9p. $0.32(BIS).

It is shown that the conventional stabilized pinch owes its stability to the co-existence of plasma and axial magnetic fields in its center. An annular discharge, with an axial magnetic field in its hollow center, is unstable against perturbations which increase greatly in amplitude between the inner and outer edge of the annulus. (auth)

11537 CEA-728

France. Commissariat à l'Énergie Atomique, Paris.

PRODUCTION ET ÉTUDE DE DÉCHARGES A FORTE INTENSITE. (Production and Study of High Intensity Discharges.) C. Breton, J. Charon, P. Hubert, G. Vendryes, and P. Yvon. 1957. 20p.

Presented at Third International Conference on the Phenomenon of Ionization in Gas, held June 11-15, 1957.

High-intensity discharges were induced in a pyrex toroid filled with argon or deuterium at low pressure. An attempt was made to stabilize the ring of plasma by the joint action of a metal screen and a longitudinal magnetic field. Penetration x rays were observed under certain conditions. (auth)

11538 ORNL-2542

Oak Ridge National Lab., Tenn.

STABILITY EFFECTS OF SURFACE CURRENTS ON A PINCHED PLASMA CONTAINING A UNIFORM VOLUME CURRENT. O. G. Harrold, Jr. June 25, 1958. 21p. Contract W-7405-eng-26. $0.75(OTS).

The stability of the pinch for an equilibrium case which has sheet currents at the surface of the pinch and a uniform pressure inside the plasma has been investigated. In addition, there was an axial magnetic field in the plasma interior, a different axial field in the outer region, and a conducting wall. The pinch stability by the method of normal modes for an equilibrium case in which the plasma contains a uniform volume current in the axial direction and a pressure which varies parabolically in the radial direction has also been investigated. However, although axial magnetic fields were considered in this case they were taken to be equal in the interior and exterior and no external conducting wall was used. Here this analysis is extended to include a finite axial field in the plasma interior with no external axial field. In addition, there is now an external conducting wall. The resulting dispersion relation is discussed. (auth)

11539

PHYSICAL LIMITATIONS FOR ENERGY PRODUCTION THROUGH NUCLEAR FUSION. H. Grümm. Atomkern-Energie 3, 228-32(1958) June. (In German)

The first part of a survey on the physical limitations and possibilities of controlled nuclear fusion is presented. In this first section, the fundamental theory of controlled fussion is discussed. (J.S.R.)

11540

THE FORMATION OF THE PLASMA STRUCTURE IN THE DEVELOPMENT OF AN ELECTRIC DISCHARGE. A. A. Zaitsev and V. E. Mitsuk (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 119, 469-70 (1958) Mar. 21. (In Russian)

The formation of stable layers in the hydrogen pulse discharge at pressures of 4.5, 3.8, and 2.8 mm of mercury was investigated. The experiments showed that in the evolving discharge the regular layers appear first on the cathode side of the positive column, then gradually expand toward the anode at several thousand meters per second. Simultaneously with the stable layer distribution on the cathode side, vibrating layers were observed in the rest of the positive column when the pulse was 7 to 8 μsec. The vibrating layers appeared in the shape of indistinct transverse bands. There were no indications of the connection between the appearance of these layers and the conditions in the vicinity of the cathode. (R.V.J.)

11541

DIFFUSION AND ELASTIC COLLISION LOSSES OF THE "FAST ELECTRONS" IN PLASMAS. G. Medicus (Wright-Patterson Air Force Base, Ohio). J. Appl. Phys. 29, 903-8(1958) June.

When the energy spectrum of plasma electrons consists of two clearly separable groups—a high-energy, primary, non-Maxwellian, and a low-energy, secondary, Maxwellian one—the characteristic linear part of the corresponding probe curves, extrapolated to plasma potential, directly determines the random current density of the fast group. With a hemispherical anode and a hollow hot cathode near its center, in Ne of about 1 mm Hg pressure, the flow of the fast group at low diode currents follows closely the spherical case of diffusion. The experimental data, by means of the diffusion law, can be evaluated for the mean free path l of the fast electrons. It is found that l is independent of the plasma density and is about equal to the value calculated from the cross-section function for 10 to 16 volt electrons in Ne. The diffusion law being applicable, the elastic collision losses of the fast group can be calculated. They are found to be relatively small compared to the total energy losses of the fast electrons. The results will be used in an attempt to determine the energy transfer from the fast group to the Maxwellian group. The most remarkable result is the low interaction of the fast group with the Maxwellian group at low total plasma densities where the partial density of the slow group is always comparable to or even much higher than that of the fast group. (auth)

11542

INVESTIGATION OF THE PERVEANCES AND BEAM PROFILES OF AN APERTURE DISK EMISSION SYS-

TEM. E. R. Harrison (Atomic Research Establishment, Harwell, Berks, England). J. Appl. Phys. 29, 909-13 (1958) June.

Argon ion beams are used for determining experimentally the perveances and the associated beam profiles of a series of electrode structures consisting of coaxial aperture disks. The results are of particular interest in the design of ion sources. Since, fundamentally, there is little difference between electron guns and ion sources, the results should also be of interest in the design and study of electron guns. Electron guns producing convergent beams, and designed on the Pierce principle of rectilinear flow, require electrodes whose shape is not always easy to reproduce or the most convenient to use. If the principle of rectilinear motion is abandoned, it is found experimentally that the perveance in many cases is little affected by the adoption of the much simpler electrode system of coaxial aperture disks. Perveance is the ratio of the output current to the $^3/_2$ power of the input voltage. (auth)

11543

STABILITY STUDIES WITH LONGITUDINAL MAGNETIC FIELD ON A STRAIGHT PINCHED DISCHARGE. L. C. Burkhardt, R. H. Lovberg, G. A. Sawyer, and T. F. Stratton (Los Alamos Scientific Lab., N. Mex.). J. Appl. Phys. 29, 964-7(1958) June.

Experiments on the effects of a longitudinal magnetic field on a linear pinched discharge indicate that the characteristic m = 0 short wavelength instabilities are suppressed by B_z fields, and that pinch life is lengthened. Measurements with a system of magnetic probes indicate that the remaining instability is a long wavelength m = 1 helix. Image converter photographs of the pinch development and the short wavelength instabilities are presented. (auth)

11544

THE LUCE IGNITION SCHEME: STEADY-STATE INJECTION IN THERMONUCLEAR DEVICES. Albert Simon. Nuclear Eng. 3, 259, 263(1958) June.

The immediate goal of various thermonuclear programs is to create a hot, fully ionized gas (or plasma) whose temperature is sufficiently high so that appreciable thermonuclear reactions will occur. One method provides for individually charged particles, already energized by a high-voltage source, to be injected into a magnetic container for trapping. This method is being pursued at Oak Ridge National Laboratory. The Oak Ridge approach, advanced by John S. Luce, is to accomplish this energetic injection and trapping through molecular breakup. (A.C.)

11545

KINETIC AND POTENTIAL ENERGIES OF AN ELECTRON GAS. N. H. March (The Univ., Sheffield, Eng.). Phys. Rev. 110, 604-5(1958) May 1.

It is pointed out that the kinetic and potential energies of an electron gas may be obtained exactly in the high-density limit by using the virial theorem in conjunction with the results of Gell-Mann and Brueckner. For intermediate and low densities, the results obtained from Wigner's formula are also referred to, although for the intermediate region these are likely to be at best semi-quantitative. (auth)

11546

MEASUREMENT OF THE ELECTRIC PROCESS IN A HIGH FREQUENCY RING DISCHARGE. Gerhard Birkhoff (Univ. of Berlin). Z. angew. Phys. 10, 204-6(1958) May. (In German)

A measuring method is given which permits, with the help of the ring discharge theory of J. J. Thomson, an investigation of a ring discharge in a cylindrical discharge vessel with respect to its discharge characteristics. The magnetomotive force, the current density, and the magnetic field strength in the plasma were determined. (tr-auth)

11547

ON THE ELECTRIC CONSUMPTION BY GASES IN THE PRESSURE RANGE OF THE HIGH VACUUM. Gerhard Strotzer. Z. angew. Phys. 10, 207-16(1958) May. (In German)

A simple kinetic description of the electric process effect was given, based on experimental data. It was shown that even at comparatively low pressures the hypothesis of the lowest bimolecular linkage process is necessary to the clarification of the sorptive behavior of the ion trap. With confinement to the bimolecular process the height of the limiting vacuum or the slope of the exponential discharge of the absorption curve is given as a linear function of the gas charge and initial pressure. A discussion of the center hypothesis leads to the result that it is not sufficient for the clarification of the absorption phenomena in the standard. The validity limits of the equation are discussed and the necessity of a normalization of the equation parameter is established. (tr-auth)

11548

PLASMA CONFIGURATION WITH SURFACE CURRENTS, WHICH ARE HELD IN EQUILIBRIUM BY A MAGNETIC FIELD. R. Kippenhahn (Max-Planck-Institut für Physik, Göttingen, Germany). Z. Naturforsch. 13a, 260-7(1958) Apr. (In German)

Configurations of a plasma with constant pressure and with surface currents which are in equilibrium with an exterior magnetic potential field are examined. With the aid of an existence theorem from the theory of partial differential equations the question of the existence of such configurations is reduced to differential-geometrical properties of the surface of the plasma. These properties are then investigated for the torus of circular cross-section with an interior azimuthal magnetic field and for a surface of axial symmetry with variable diameter. Finally a torus of variable cross section is treated approximately. (auth)

11549

INVESTIGATION OF THE "GAS IONIZING" RADIATION OF A DISCHARGE. A. Przybylski (Univ. of Hamburg). Z. Physik 151, 264-80(1958). (In German)

An ionization chamber (rotation ellipsoidal form) was described with which the absorption coefficient of a gas ionizing radiation could be measured. When the surface photo-effect is avoided, one influence of the measurement is excluded by the effect of the long wave radiation which can not ionize the gas. With this arrangement which permits monochromatism to be attained, the gas ionizing radiation of a corona discharge in O_2 was investigated. At pressures over 10 Torr a monochromatic radiation component with $\mu_{760} = 38\ cm^{-1}$ was reached in the chamber. At lower pressures two additional components penetrated whose absorption coefficients were estimated. The values lie between 250 and 550 cm^{-1}. The number of photons emitted from the discharge gap per electron is given. It is 3 to 6×10^{-4} for the component with $\mu = 38\ cm^{-1}$ in the pressure range from 10 to 30 Torr. The effect of the alcohol vapor on the absorption and composition of the gas ionizing radiation of a mixture of air and argon was investigated. Air and argon were used as the tube gas. A value of the absorption coefficient was considered which had been obtained by others by a different method (determination of the

ignition probability). For the comparable alcohol admixtures of 0.2 and 0.3 Torr the characteristic absorption coefficient (converted to 760 Torr) lies between 440 and 480 cm^{-1}. (tr-auth)

11550

DIRECT DEVELOPING OF METAL SURFACES WITH ION EMITTED ELECTRONS. W. Bayh (Univ. of Tübiagen, Germany). Z. Physik 151, 281-95(1958). (In German)

In the microscope for the direct developing of metal surfaces with electrons, which are emitted by ion impact, the cathode of an electrostatic 50 kev immersion objective serves as the object. The tunnel radiation from a laterally connected discharge tube hits below an angle of about 10° to the surface. Through improved physical and technical construction of the tunnel ray tubes, constant emission was assured and earlier reactions on the picture reproduction were avoided. By exact adjustment and optimal limitation of the aperture diaphragm, a resolution of 500 A was obtained. The theoretical limit according to the Recknagel theory is at 150 A. The impressioned relief produced by the plane impurity angle of the ion beam was shown as a function of the angle. Five to 10° was the best, since at smaller angles the long shadows often obscured the fine structure and the spattering effect becomes larger. The effect of the ion bombardments was studied and a method for the production of the formation without essential damage to the surface was given. With an exposure of cast iron with carbon and sulfide inclusions the outstanding material difference because of the different electron yields was indicated. (tr-auth)

11551

THE ELECTRICAL BREAKDOWN OF GASES IN THE PRESENCE OF CROSSED ELECTRIC AND MAGNETIC FIELDS. H. A. Blevin and S. C. Haydon (Univ. of New England, Armidale, Australia). Z. Physik 151, 340-4 (1958).

The breakdown characteristics of a gas in the presence of crossed electric and magnetic fields are discussed in terms of the Townsend ionization coefficients. The "equivalent pressure" concept is used to assess the effect of a transverse magnetic field on the first Towsend coefficient and the objections which have been raised to the application of this approach to breakdown potentials are shown to be removed by a consideration of the dependence of the second Townsend coefficient upon electric and magnetic field strengths. (auth)

11552

THE ELECTRIC CONDUCTIVITY OF A PLASMA II. H. Schirmer and J. Friedrich (Osram-Studiengesellschaft, Berlin). Z. Physik 151, 375-84(1958). (In German)

The exact theory of the electric conductivity of a plasma requires the calculation of the velocity distribution of the electrons from the Boltzmann equation. In the first part of the work the fundamental Boltzmann equation is constructed. In the following two parts the detection of the cross section, the investigation of the convergence character of the solution, and the calculation of the magnitude of the electron interaction effects are discussed. (tr-auth)

11553

SPECTROSCOPIC INVESTIGATION OF A POWERFUL PULSED DISCHARGE IN HYDROGEN. II. S. Yu. Lukyanov and V. I. Sinitsyn. Zhur. Eksptl'. i Teoret. Fiz. 34, 849-55(1958) Apr. (In Russian)

Mirror scanning was used to investigate the spectral properties of the radiation from the hydrogen plasma in a low pressure gas discharge involving currents up to 500 ka. The temporal behavior of the discharge spectrum in the visible region may be studied by the above method. During compression of the plasma striation a flash in the continuous spectrum is observed. Results obtained by adding nitrogen and helium indicate a high electron temperature in the plasma at these moments. An estimate of the concentration of the charged particles is made on basis of broadening of the H_α line. (tr-auth)

11554

CONCENTRATION OF NEGATIVE IONS IN THE PLASMA OF A POSITIVE COLUMN. M. V. Konyukov (Tula Pedagogical Inst.). Zhur. Eksptl'. i Teoret. Fiz. 34, 908-11(1958) Apr. (In Russian)

The concentration of negative ions in a positive column is considered. The effect of volume recombination of positive and negative ions on the concentration of the latter near the discharge axis is investigated. (tr-auth)

Electrons

11555

ENERGY SPECTRUM OF A BUNDLE OF 40 kv ELECTRONS REFLECTED BY A METALLIC OBJECT. Ferdinand Pradal and Robert Saporte. Compt. rend. 246, 2880-3(1958) May 19. (In French)

The energy spectra of electrons reflected by different metal targets (Cu, Ni, Ag, Pt, Pb, Al, Cr, Bi, U, Mo, and Mn) were studied with a magnetic spectrograph. The effect of the crystalline state of the target and the appearance of a background loss in the case of weak deviations are shown. (tr-auth)

11556

CIRCULAR POLARIZATION OF BREMSSTRAHLUNG FROM HIGH ENERGY ELECTRONS WITH ARBITRARY POLARIZATION. C. Fronsdal and H. Überall (CERN, Geneva). Nuovo cimento (10) 8, 163-5(1958) Apr. 1.

In view of the recently discovered possibilities of producing polarized electrons in parity-violating weak interactions — β decay and μ-meson decay — circular polarization of bremsstrahlung becomes of interest as a means for detecting the polarization. The bremsstrahlung circular polarization is found to be sensitive to transverse polarization; thus at high energies, $E_1 \gg mc^2$, where Coulomb scattering is no longer feasible, it offers another possibility for detecting transverse electron spins. The Born approximation differential cross section was derived, and a summation over final electron spins and integration over final electron momenta were performed, with a result feasible for experimental application. The following general results were found: (1) bremsstrahlung is both linearly and circularly polarized; (2) the linear polarization is independent of any polarization of the initial electron; (3) circular polarization occurs only for polarized initial electrons, (4) if this circular polarization is not observed, the radiation has the same angular distribution and spectrum as that from unpolarized electrons. (A.C.)

11557

ELECTRON LOSS CROSS SECTIONS FOR HELIUM ATOMS IN THE KINETIC ENERGY RANGE 100-450 kev. Samuel K. Allison (Univ. of Chicago). Phys. Rev. 110, 670-2(1958) May 1.

New measurements of the electron loss cross sec-

tion for helium atoms in the kinetic energy range 100 to 450 kev are reported. It has been suggested that previous discrepancies between observers have been partially due to the fact that the neutral beams used contained varying amounts of metastable $1s2s\ ^3S_1$ atoms, depending on the pressure of the gas in which the He^0 beam was formed by electron capture from He^+. It is established that the new measurements were made on helium atomic beams whose loss cross sections were independent of the pressure at which they were prepared over a 10-fold variation. The new values show the same trend with kinetic energy and the same relative values in H_2, He, and air as those previously reported in the 100 to 450 kev range, but their absolute values are lower. The new values agree with those obtained in other laboratories in the range 100 to 200 kev. The results are tabulated. (auth)

11558

IONIZING ENERGY OF ELECTRONS IN GERMANIUM CRYSTALS. V. S. Vavilov, L. S. Smirnov, and V. M. Patskevich. Soviet Phys. (Doklady) 2, 93-5(1957) Jan.-Feb.

The mean energy of ionization in germanium excited by electrons of 5 to 15 kev was determined. The value of ϵ, the average energy expended in the production of one pair of carriers, was measured as 3.7 ± 0.4 ev, and it did not vary with the variation of the energy of the primary electron from 5 to 15 kev. (J.S.R.)

11559

ELECTRON POLARIZATION IN β-DECAY. A. I. Alikhanov, G. P. Yeliseev, V. A. Lyubimov, and B. V. Ershler (Academy of Sciences, USSR.). Zhur. Eksptl'. i Teoret. Fiz. 34, 785-99(1958) Apr. (In Russian)

In connection with the revision of the law of parity conservation some experiments were carried out for the detection of longitudinal polarization of electrons emitted in β decay. It is found that the β electrons are emitted with a spin opposite to the direction of motion. The degree of longitudinal polarization is consistent with the value v/c. (tr-auth)

11560

POLARIZATION AND ANGULAR DISTRIBUTION OF X-RAY QUANTA EMITTED AFTER ELECTRON CAPTURE BY A NUCLEUS OR AFTER A CONVERSION TRANSITION. A. Z. Dolginov (Leningrad Inst. of Physics in Technology). Zhur. Eksptl'. i Teoret. Fiz. 34, 931-41(1958) Apr. (In Russian)

The case of K- or L-capture of any degree of forbiddenness with account of nonconservation of parity is discussed. It is shown that observation of the correlation between the polarizations of x-ray quanta emitted by the atom after K- or L-capture and the direction of the nuclear spins or the polarization of the subsequent nuclear radiation yields important data on β interaction. The angular distribution of the x-ray quanta is anisotropic if capture occurs in the L_{III} shell. Some formulas are presented which permit the determination of spins and parities of nuclear levels by observing the polarization of x-ray quanta after conversion transitions. (tr-auth)

11561

ON THE CHERENKOV RADIATION OF LONGITUDINALLY POLARIZED ELECTRONS. A. A. Sokolov and Yu. M. Loscutov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 34, 1022-3(1958) Apr. (In Russian)

A summation is given of the data on the Cherenkov radiation of electrons with longitudinal polarization. (R.V.J.)

Gases

11562

COMMENTS ON THE SENFTLEBEN METHOD FOR THE DETERMINATION OF THE HEAT CONDUCTIVITY, THE SPECIFIC HEAT, AND THE VISCOSITY OF GASES. Sigurds Arajs and Sam Legvold (Iowa State Coll., Ames, Iowa). J. Appl. Phys. 29, 1001(1958) June.

In computing the coefficient of viscosity for various gases, it was found that data for many gases did not fall on Senftleben's correlation curve. Although the Senftleben method cannot provide reliable values of the viscosity of gases, the examination using O_2, N_2, and Ar showed that the coefficient of the molecular heat conductivity and the specific heat at constant pressure could be determined with deviations of about 5% from the corresponding values obtained by standard techniques. (W.D.M.)

Instruments

11563 AECU-3734

Du Mont (Allen B.) Labs., Inc. Tube Operations-[Engineering], Passaic, N. J.

EVALUATION OF FOREIGN MULTIPLIER PHOTOTUBES. John Bolakas and Percy G. Parker. [1958]. 30p. Contract AT(30-1)-1336. $4.80(ph OTS); $2.70 (mf OTS).

Several multiplier phototubes produced by England, Russia, or Switzerland were evaluated for amplification, photocathode sensitivity, photoelectron collection efficiency, cathode uniformity, and dark current. A description of the various tubes by designation numbers is given, along with a description of techniques and equipment used in testing. (J.R.D.)

11564 AERE-GP/R-2372

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A FULL RADIATION PYROMETER SUITABLE FOR TEMPERATURE MEASUREMENTS IN THE RANGE 0° TO 100°C. M. G. Davies and H. Kronberger. 1958. Date of MS. Sept. 31, 1951. Decl. with amendments Apr. 25, 1957. 6p. $0.24(BIS).

Declassified version of AERE-G/R-783.

A full radiation pyrometer is described having in vacuo an accuracy of ½°C at 70°C. The action depends on a thermal null method. Readings are therefore independent of the emissivity of the surface. (auth)

11565 SCTM-58-58-81

Sandia Corp., Albuquerque, N. Mex.

RADIATION GAGE TECHNIQUES FOR MEASUREMENT OF DENSITY VARIATION. G. J. Miller. June 6, 1958. 19p. Contract AT(29-1)-789. $3.30(ph OTS); $2.40(mf OTS).

Some of the fundamental principles and techniques involved in measuring density variation with radiation gages are presented. (auth)

11566 SCTM-162-58(14)

Sandia Corp., Albuquerque, N. Mex.

MANUALLY OPERATED OSCILLOSCOPE CAMERA POSITIONING MECHANISM. Paul L. Kerley and Chester J. Smith. May 7, 1958. 7p. Contract AT(29-1)-789. $1.80(ph OTS); $1.80(mf OTS).

A system is described which provides for a more economical use of the Polaroid-Oscilloscope Camera by permitting a total of four complete pictures of the entire

oscilloscope face in place of the two previously possible. (auth)

11567

STANDARDIZED FUNCTIONAL ELEMENTS FOR ELECTRONICS DEVELOPED BY THE COMMISSARIAT À L'ENERGIE ATOMIQUE. H. Guillon (Centre d'Etudes Nucleaires, Saclay, France). L'Onde Electrique No. 361, 4p. (1957) Apr. (In French)

The advantages obtained from the use of standardized functional elements developed by the C.E.A. to be units in electronic devices are discussed. These units, designed for low-cost quantity production, feature high operational flexibility. A definition of their primary functions is given. The wide variety of combinations possible with these units is illustrated with typical examples showing how they are used in the development of more complex devices. (tr-auth)

11568

NONDESTRUCTIVE TEST FOR RADIATION EFFECTS. J. D. Matlack and S. Strella (Picatinny Arsenal, Dover, N. J.). Nucleonics 16, No. 6, 103-5(1958) June.

A study of radiation effects on the mechanical properties of polystyrene, phenolic material, polyethylene, and polymethyl methacrylate by the nondestructive vibrating reed test is described. (W.D.M.)

11569

TEMPERATURE-REGULATED BISMUTH RESISTOR FOR MAGNETIC-FIELD MEASUREMENTS. Charles G. Dols, Edson W. Skiff, and Peter G. Watson (Univ. of California, Berkeley). Rev. Sci. Instr. 29, 349-54 (1958) May.

The magnetoresistance effect of the metal bismuth has been used in measuring magnetic induction for many years. This report describes significant features of the electrical and mechanical design of an electrically temperature-regulated resistor assembly and associated equipment. Commercial ductile bismuth wire was successfully used in a small probe. Useful resolution of 2 gauss in fields above 5000 gauss was readily attained. Limitations and advantages of bismuth resistors as devices for measuring magnetic induction are discussed briefly. Some data from the use of the first units are presented. (auth)

11570

ROCKING-BOMB CALORIMETER FOR MEASURING HEATS OF SOLUTION. Stuart R. Gunn (Univ. of California, Livermore). Rev. Sci. Instr. 29, 377-80 (1958) May.

A calorimeter designed for measuring the heats of rapid reactions such as dissolution and hydrolysis near room temperature is described. The instrument consists of a sealed copper bomb suspended in an evacuated submarine immersed in a thermostat; stirring is accomplished by rocking the assembly through an arc of 150°. Measurements of the heat of solution of potassium chloride in water at 25.00°C have been performed. (auth)

11571

VAPOR PRESSURE APPARATUS. Marshall W. Cook (Univ. of California, Livermore). Rev. Sci. Instr. 29, 399-400(1958) May.

A vapor pressure apparatus has been developed which has certain manipulative and accuracy advantages over the well-known isoteniscope. A reliable criterion for complete degassing is inherent in the apparatus. Since degassing is required only once for a series of determinations at various temperatures, the apparatus is well adapted where the amount of sample is limited. The useful temperature range of this apparatus is between the freezing point of mercury and the temperature at which the vapor pressure of mercury becomes appreciable. The apparatus may not be used if the sample reacts chemically with mercury. (auth)

Isotopes

11572

RADIOACTIVE ISOTOPES: THEIR PRODUCTION AND APPLICATION. Kurt Schmeiser. Berlin, Springer-Verlag, 1957. 255p. (In German)

A brief survey of atomic structure and the production of artificial radioisotopes serves as an introduction to a detailed study of radiation detection instruments. The ionization chamber, Geiger-Mueller tube, proportional counter, and scintillation counter are discussed. The impulse amplifier is briefly mentioned. The passage of beta, gamma, and alpha radiation through matter and the detection of each is treated separately. Absolute measurements of radioactivity are discussed. Methods, applications, and advantages of autoradiography are described. The effects of radiation, protection against it, and the laboratory equipment needed for work with radioisotopes are then reviewed. The book closes with a survey of the applications of radioisotopes to chemistry, medicine, biology, geology, mineralogy, and other technical fields. (J.S.R.)

11573

MASSES OF LEAD ISOTOPES. R. A. Demirkhanov, T. I. Gutkin, and V. V. Dorokhov. Doklady Akad. Nauk S.S.S.R. 118, 1103-4(1958) Feb. 21. (In Russian)

The masses of Pb^{204}, Pb^{206}, Pb^{207}, and Pb^{208} were measured to determine the energy of the nucleonic bond in nuclei in the magic number region with 82 protons and 126 neutrons. The mass of Pb^{208} was corrected and used as the basic magnitude for calculations of the mass for the heavy isotopes with $Z \leq 82$. The results showed that within the limits of error the value ΔM for each doublet $Pb^{208}-C_{14}H_{18}O_2$, $Pb^{207}-C_{14}H_7O_2$, and $Pb^{206}-C_{16}H_{14}$ coincides regardless of the ionic origin (atomic or dissociative). (R.V.J.)

Isotope Separation

11574

SEPARATION PARAMETER IN THE SYSTEM $N^{15}O/N^{14}O$. W. Kuhn, A. Narten, and M. Türkauf (Univ. of Basel). Helv. Chim. Acta 41, 669-70(1958). (In German)

The separation parameter with respect to N^{15} measured in liquid NO at 120°K (745 torr) was measured as $N^{15}O/N^{14}O = -1.7 \times 10^{-2}$. (tr-auth)

11575

SEPARATION OF LIQUID ISOTOPIC SOLUTIONS OF HELIUM AT VERY LOW TEMPERATURES. R. Chentsov. Uspekhi Fiz. Nauk 64, No. 1, 195-6(1958) Jan. (In Russian)

The intersolubility of He^3-He^4 solutions was measured in the temperature interval from 1.2 to 0.25°K. The very low temperatures were reached by method of adiabatic demagnitization of paramagnetic salts. At temperatures below 0.7 to 0.8°K the investigated solutions of He^3-He^4 with 40 to 60% He^3 separated into two phases with various concentrations of He^3. The lighter phase occupied the upper part of the container and the heavier the lower part. At T = 0.25°K the heavy phase contained ~ 7% He^3 and the lighter phase ~ 10% He^4. The extrapolation of the phase diagram seems to be in agreement with the hypothesis on the He^3-He^4 separation into pure single phases at absolute zero temperature. (R.V.J.)

Mass Spectrography

11576
EXPERIMENTAL INVESTIGATION ON THE AMBIPOLAR EFFUSION FROM THE POSITIVE COLUMN.
U. Weimer (Max-Planck-Gesellschaft, Hechingen).
Z. Naturforsch. 13a, 278-85(1958) Apr. (In German)

In an effusion method for ion extraction from the positive column in a low-pressure gas discharge in which the use of metal parts and voltage fluctuations inside the plasma was avoided, the ion effusion current was determined in the undisturbed plasma. Measured effusion currents (some 10^{-9} amp) from a helium discharge with different discharge current strengths (1.5 to 8 ma) and discharge pressures (0.2 to 3.9 torr) were given and compared with the values calculated for the Schottky case from the theory of ambipolar effusion. The measured intensities of the effusion current and its dependence on the discharge parameters were described by this theory. The ion current from a neon discharge was analyzed with a mass spectrometer. The ion currents from Na^{20} and Na^{22} were within the measurement accuracy (±2%), as was the natural isotopic mixture ratio of Ne^{20} to Ne^{22}, so that a possible mass separation by the effusion jet could not be detected. (tr-auth)

Mathematics

11577 AECU-3643(Pt. II)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
TRANSIENT THERMAL STRESSES IN PRESSURE VESSELS. PART II. THERMAL STRESS CALCULATION.
J. P. de Vries and R. C. Nicoll. Apr. 30, 1958. 48p. Project 2500. Contract IWR-73-A-129146. $7.80(ph OTS); $3.30(mf OTS). (ADD-58-12).

The second part of an IBM 704 Computer Code to determine transient thermal stress in pressure vessels is described. This part computes stresses from temperature distribution determined by the first part. A brief account is given of the solution of axially symmetric thermal stresses, using harmonic stress functions. This is followed by a description of the Code and complete input and operating instructions for a number of problems. The code is known as TURF6. It was found that the computer results for thermal stresses in a solid sphere subjected to a sudden change of temperature at the surface corresponded within 5% of the theoretical values. The IBM 704 Computer required for this code has a 16 K memory, three drums and two tape units. (auth)

11578 AECU-3668
Illinois. Univ., Urbana. Digital Computer Lab.
A STUDY OF PARALLEL ONE'S COMPLEMENT ARITHMETIC UNITS WITH SEPARATE CARRY OR BORROW STORAGE (thesis). Report No. 81. Gernot Metze. Nov. 11, 1957. 81p. Contract AT(11-1)-415. $12.30(ph OTS); $4.50(mf OTS).

Speed increases resulting from the logical re-design of the arithmetic unit of a computer which uses the one's complement system of number representation are described. (W.L.H.)

11579 AECU-3756
Illinois. Univ., Urbana. Digital Computer Lab.
TECHNICAL PROGRESS REPORT. PART I. HIGH-SPEED COMPUTER PROGRAM. PART II. MATHEMATICAL METHODS. PART III. ILLIAC USE AND OPERATION—GENERAL LABORATORY INFORMATION. Mar. 1958. 21p. Contracts AT(11-1)-415; N6ori-07130; and Nonr-1834(15). $4.80(ph OTS); $2.70(mf OTS).

Research on circuits and design of a very high-speed computing machine is discussed. Topics such as mathematical research and programming and general laboratory information on Illiac use and operation are discussed. (For preceding period see AECU-3686.) (W.L.H.)

11580 AFOSR-TN-58-29
Columbia Univ., New York. School of Engineering.
COMPLEX PLANE SCANNER. Final Report. Technical Report T-26/B. C. M. Alaia and P. H. Oden. Jan. 15, 1958. 78p. Project No. 47501. Contract AF18(600)-677. (CU-41-58-AF-677-EE; AD-152220).

A description of the circuits and the general theory of operation of a specialized type of analog computer, the Complex Plane Scanner is given. Essentially, this computer will automatically map contours in the complex frequency plane into an arbitrary function plane. For example, Bode Plots, Nichols Charts, and modified Nyquist Diagrams can easily be plotted. The Complex Plane Scanner is thus a useful tool in the design and analysis of networks and feedback control systems. A brief résumé of pertinent theory and applications of the computer is presented. (auth)

11581 CF-58-6-30
Oak Ridge National Lab., Tenn.
A MONTE CARLO CODE FOR DEEP PENETRATIONS OF GAMMA RAYS. S. K. Penny. June 4, 1958. 9p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80 (mf OTS).

Paper presented at Shielding Information Meeting, May 14-15, 1958, Marietta, Ga.

This code employs special techniques for the express purpose of trying to obtain reasonable estimates of deep penetrations of gamma rays in an infinite medium emitted from a point monoenergetic source. The code is presently in the "debugging" stage and will be tested against well known standards before it is used for production. (auth)

11582 GAT-DM-619(Rev. 1)
Goodyear Atomic Corp., Portsmouth, Ohio.
A MODIFIED SPECIAL PURPOSE SLIDE RULE FOR COMPUTING SOLID ANGLES. Revision No. 1. J. L. Feuerbacher. Nov. 19, 1957. 6p. Contract [AT(33-2)-1]. $1.80(ph OTS); $1.80(mf OTS).

A description is presented of a solid-angle slide rule which makes use of the basic framework of a standard slide rule with a single movable section and two stationary sections. A temporary working model has been made, using photographed scales on one side of the slide rule. Use of the slide rule is described. (auth)

11583 SCR-11
Sandia Corp., Albuquerque, N. Mex.
LECTURES ON GAME THEORY, MARKOV CHAINS, AND RELATED TOPICS. Gerald L. Thompson. Mar. 1958. 85p. Contract AT(29-1)-789. $13.80(ph OTS); $4.80(mf OTS).

Notes on nine lectures delivered at Sandia Corporation in August 1957 are given. Part one contains the manuscript of a paper concerning a judging problem. Part two is concerned with finite Markov-chain theory and discusses regular Markov chains, absorbing Markov chains, the classification of states, application to the Leontief input-output model, and semimartingales. Part three contains notes on game theory and covers matrix games, the effect of psychological attitudes on

the outcomes of games, extensive games, and matrix theory applied to mathematical economics. (auth)

11584 SCR-13
Sandia Corp., Albuquerque, N. Mex.
TABLES OF FACTORS FOR ONE-SIDED TOLERANCE LIMITS FOR A NORMAL DISTRIBUTION. Donald B. Owen. Apr. 1958. 131p. Contract AT(29-1)-789. $19.80(ph OTS); $6.30(mf OTS).

Tables of factors for a one-sided tolerance limit computed from a sample drawn from a normal distribution are presented. The tables originate from four sources, and the accuracy of the tables from these sources is compared. The factors are percentage points of the noncentral t-distribution, and as such can be used in designing certain acceptance sampling plans. (auth)

11585 WAPD-P-707
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SWAP MU AND NU. N. L. Barnett. Oct. 1956. 8p. $1.80(ph OTS); $1.80(mf OTS).

A code is described, now in production on the IBM-704, which is designed to compute the uncollided particle flux as a function of the distance from a homogeneous cylinder containing a uniform isotopic source distribution, assuming that the attenuation of the particles is exponential both within the cylinder as well as in the attenuating shells of slabs. (T.R.H.)

11586 WAPD-TM-117
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE PREP CODE FOR CALCULATING GROUP AND ANGLE TRANSFER CROSS SECTIONS OF ELASTIC SCATTERING FOR THE RDR-5 TRANSPORT CODE ON THE NORC COMPUTER. Harvey J. Amster and Linwood M. Culpepper. Feb. 1958. 14p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

11587
ANALYTICAL REPRESENTATION OF ANGULAR DISTRIBUTION DATA. S. C. Snowdon, L. Eisenbud, and J. F. Marshall (The Franklin Inst., Swarthmore, Penna.). J. Appl. Phys. 29, 950-3(1958) June.

A simple method is presented for obtaining an analytical curve fitted to data points. The requirements in least squares analysis that yield a single best curve are relaxed to the extent that it is only necessary to choose one of many possible good fits. The subsequent analytical determination of this good curve may be obtained with relatively little computational effort. Specifically, the method is applied to an analytical representation of angular distribution data by means of a Legendre polynomial series. A smooth curve which one feels is statistically justified is drawn through the data points. The values of this curve at eleven points are chosen as the coefficients in a Lagrange interpolation function series. The intermediate points give back approximately the drawn curve and are also statistically adequate. Subsequent use of a transformation matrix between the Lagrange interpolation basis and the Legendre polynomial basis yields the desired expansion. The transformation matrix is presented for the case in which an 11-point fit adequately characterizes the data curve. Error estimates also are given. (auth)

11588
ANALOGOUS SOLUTION OF A TRANSPORT EQUATION. J. Devooght (Univ. of Brussels). J. Nuclear Energy 6, 338-9(1958) May. (In French)

The use of resistance networks in solving general transport equations is briefly discussed. (T.R.H.)

11589
ANALYTICAL PROPERTIES OF THE SOLUTIONS OF THE CHEW-LOW EQUATIONS. M. Froissart and R. Omnès (CERN, Geneva). Nuclear Phys. 6, 628-9 (1958) May.

It is shown that the solutions of the Chew-Low equations can be continued analytically. In a few simple cases, this continuation leads to a finite Riemann surface with two sheets. In the general case, however, the number of sheets is infinite. (auth)

11590
ON THE SOLUTION OF CERTAIN SINGULAR INTEGRAL EQUATIONS OF QUANTUM FIELD THEORY. R. Omnes (CERN, Geneva). Nuovo cimento (10) 8, 316-26(1958) Apr. 16.

In the study of complex phenomena involving π-mesons (e.g. simple and double photoproduction, radiative scattering, double production, etc.) one encounters singular integral equations linking the matrix elements and phase-shifts. We give here a general method of resolution of these equations which furnishes the following results: (a) the simplest type is integrable by quadratures; (b) the general type is reducible to a Fredholm equation. We give also the solution of a system of coupled integral equations and of the particular one which occurs in the double production problem. This last case may be integrated by quadratures. (auth)

11591
A DIGITAL PROGRAM TO EVALUATE TRANSIENTS FOR NUCLEAR POWER PLANT DESIGN. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 54, Session 30. F. J. Scheib and A. J. Arker (General Electric Co., Schenectady, N. Y.). New York, American Institute of Chemical Engineers, 1958. 18p.

The design limitations of a nuclear power plant for mobile use are often dependent upon the transients which the plant undergoes during normal or casualty operation. Examples of decisions which are dependent upon transient evaluation in the design of a pressurized water plant are given. The model of an IBM-704 digital computer program used to analyze such transients is described. It contains a reactor, two coolant piping loops, two steam generators, two turbines, and associated control systems. Important features of this program are nonsymmetrical and variable flow operation of the two coolant loops, use of nonanalytic input data, and flexibility for alteration. Basic equations of the model are included. (auth)

11592
VARIABLE TRANSPORT LAG SIMULATION. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 112, Session 30. E. G. Holzmann (General Electric Co., San Jose, Calif.). New York, American Institute of Chemical Engineers, 1958. 27p.

In the study of transients in nuclear and chemical plants, it is often necessary to consider the effect of variable transport lag due to variable mass flow rate. A circuit to simulate such an effect, using conventional analog computing components, is described. A voltage to control the transport lag can be generated as part of the problem solution. It may correspond to pump speed or flow rate. Advantages of this circuit are simplicity, wide range of delay times, and economy of equipment. (auth)

11593
THE OPERATOR APPROACH TO PROBLEMS OF STABILITY AND CONVERGENCE OF SOLUTIONS OF DIFFERENCE EQUATIONS AND THE CONVERGENCE OF VARIOUS ITERATION PROCEDURES. Arnold N.

Lowman. New York, Scripta Mathematica, 1957. 109p. Available from the Office of Technical Services, Washington for $3.00.

A systematic and detailed description of the operator method is given, based essentially on ideas previously published. The method is illustrated for difference equations of both explicit and implicit types arising in the numerical treatment of the partial differential equations of heat condition in one and two dimensions, for the Richardson iteration process as applied to the Laplace differential equation in two dimensions, for the various iteration procedures associated with implicit difference equations, and for difference analogs of the partial differential equation of wave motion. The analysis is predicted on the knowledge of the eigenvalues of certain matrices. An alternative analysis of stability and convergence requiring merely the knowledge of upper bounds of the eigenvalues of matrices, or based on known criteria for the convergence of high powers of matrices to the zero matrix, is discussed in several appendices. (M.H.R.)

Measuring Instruments and Techniques

Refer also to abstracts 11440 and 12105.

11594 DP-267

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

NEUTRON MONITOR FOR PLUTONIUM INVENTORY CONTROL. William A. Kropp. Jan. 1958. 15p. Contract AT(07-2)-1. $0.50(OTS).

In processes for recovery of spent fuel from nuclear reactors, careful control of plutonium inventory is necessary. Instrumentation is described for determining the plutonium inventory in process vessels by measuring neutron activity associated with plutonium compounds. Instruments have been used successfully in plutonium inventory measurement for more than a year. (auth)

11595 HW-56199

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

NEUTRON MEASUREMENTS III: CALIBRATION OF LONG COUNTER NO. 2 WITH RADIOACTIVE NEUTRON SOURCES. J. De Pangher. May 15, 1958. 36p. Contract [W-31-109-Eng-52]. $6.30(ph OTS); $3.00(mf OTS).

Arguments are presented to show that the relative average efficiency of long counter No. 2 (BF_3 ionization type) is 0.90 for Ra–α–Be neutrons. The relative efficiency is also calculated for other neutron sources. A secondary standard for calibrating BF_3 tubes is described. (auth)

11596 INSJ-9

Tokyo Univ. Inst. for Nuclear Study.

TOTAL ABSORPTION ČERENKOV DETECTORS AND A MEASUREMENT OF ENERGY FLOW IN THE EXTENSIVE AIR SHOWER. Tsuneo Matano, Isao Miura, Minoru Oda, Koichi Suga, Goro Tanahashi, and Yasuo Tanaka. Apr. 10, 1958. 36p.

Some details regarding Cherenkov detectors which were designed for the measurement of the energy flow of electronic components in the extensive air shower are described. The principle of the detectors is the utilization of the Cherenkov radiation from electrons of cascade showers produced in the heavy material, viz. lead glass and lead nitrate solution in the present study. The lateral distribution of the energy flow carried by the electronic and nuclear-active components was studied with these detectors, and the distribution function was tentatively concluded to be $r^{-1.1 \pm 0.2} f(\gamma)$, where $f(\gamma)$ is the lateral distribution function of the density of electrons. (auth)

11597 UCRL-3789

California. Univ., Berkeley. Radiation Lab.

RANGE-ENERGY RELATION FOR LIQUID HYDROGEN BUBBLE CHAMBERS (thesis). Glenwood Clark, Jr., and William F. Diehl. May 1957. 37p. Contract W-7405-eng-48. $6.30(ph OTS); $3.00(mf OTS).

Submitted to the United States Naval Postgraduate School, Monterey, Calif.

In studying the kinematics of the formation, reactions, and decay of unstable strange particles such as $K^{\pm}$, Λ^0, θ^0, and $\Sigma^{\pm}$ with a liquid hydrogen bubble chamber a range-energy relation is essential. To obtain such a relation, one must know the density of superheated liquid parahydrogen. Heretofore, this density has not been determined. Direct measurement by conventional means of the density of the liquid hydrogen in the bubble chamber is difficult because the liquid is superheated for only 20 to 30 milliseconds. To determine the density, the mean range of μ^+ mesons produced by π^+ mesons decaying at rest in the 10-inch UCRL liquid hydrogen bubble chamber was measured and found to be 1.103 ± 0.003 cm (standard deviation 5.0%; 444 $\pi \rightarrow \mu \rightarrow e$ events). From the Bethe-Bloch theory and a μ^+ kinetic energy of 4.12 ± 0.02 Mev, this value of range gave a density of $(5.83 \pm 0.06) \times 10^{-2}$ g/cm^3 for superheated liquid parahydrogen. The temperature and pressure of the hydrogen during the sensitive time were 27.6 ± 0.1°K and 48 ± 5 psia. A plot of the range-energy relation for protons, π, μ, K, Σ, and Ξ particles based on Bethe-Bloch theory, and the above value of density is given for kinetic energy values ranging from 1 to 1000 Mev. (auth)

11598 UCRL-8274

California. Univ., Berkeley. Radiation Lab.

PRELIMINARY TESTING OF A PROPORTIONAL COUNTER FOR NEUTRON SPECTROSCOPY WITH HELIUM-3 (thesis). John N. Green. Apr. 21, 1958. 60p. Contract W-7405-eng-48. $9.30(ph OTS); $3.60 (mf OTS).

Submitted to the United States Naval Postgraduate School, Monterey, Calif.

The $He^3(n,p)T$ reaction can be utilized in a proportional counter for neutron-energy determination in the region 100 kev to 1 Mev. This has already been demonstrated and the reaction cross section in this energy region has been measured with a counter. For practical application of the counter as a spectrometer, such as in health physics work, it is desirable to increase the counter efficiency. A proportional counter utilizing an anticoincidence ring to reduce wall effect has been constructed for this purpose. Some preliminary tests of the proposed system are described. (auth)

11599 USNRDL-TR-242

Naval Radiological Defense Lab., San Francisco.

A SCINTILLATION DETECTOR FOR GAMMA RADIACS. W. R. Lamb. Dec. 20, 1957. 46p.

As part of the general program looking toward making available efficient nuclear radiation detectors, the development of a sensitive photodiode, the matching of a scintillant, and the optical-mechanical coupling of the two components are reported. The properties of the radiation transducer which are important to a field radiac application are examined. A detector containing, for example, 75 ml of liquid scintillant viewed by a photodiode has a specific output of 1.1×10^{-10} amp/r/hr. The output is proportional to gamma dose rate through

at least 8 decades to about 10^7 r/hr. The response is independent of photodiode potential when more than a few volts are applied. The temperature coefficient is −0.4% of electrical current per degree Celsius. The dependence of the current output on energy of the incident radiation can be modified so that virtual independence of energy is attained in the 90 to 1300 kev region by employing suitable filtration and compensating scintillants. The detector's output is inherently independent of the direction from which the measured radiation comes. The work has shown that the detector evolved can be an efficient component of a radiac having size and sensitivity competitive with those of the conventional ionization chamber. (auth)

11600 AEC-tr-3275

4 π COUNTER AND MEASUREMENTS FOR THE ABSOLUTE DETERMINATION OF SLIGHT SPECIFIC ACTIVITIES OF RADIATORS POOR IN ENERGY. Manfred Leistner. Translated for Westinghouse Electric Corp. from Z. angew. Phys. 8, 331-7(1956). 18p.

The construction of a 4 π counter is described in detail: two different models of the counter tube are indicated and their counter properties are investigated. Absolute determinations on a radiator with varied qualitative and energetic radiations are discussed. Special measurements for the determination of radiation and scattering are evaluated. A combination counter tube is proposed for the simplification and facilitation of the measurements. (auth)

11601 AEC-tr-3290

NEW DETECTOR OF NEUTRONS FROM FISSIONS IN GAS STREAM. L. Koch. Translated by K. S. Bevis. (Savannah River Lab.) from J. Nuclear Energy 5, 357-61(1957). 6p.

With the instruments and methods described it is possible to measure, at any time, a flux of slow neutrons in presence of very intense fluxes of γ rays; fission products are carried by a gas stream past a β, γ counter. The minimum measurable flux is of the order of a few thermal neutrons per cm^2 and per sec. The power of a nuclear reactor can be easily followed; neutron density maps can be plotted very accurately as soon as fluxes are greater than 10^8 cm^{-2} s^{-1}. Temperature resistance is excellent. (auth)

11602

A SCINTILLATION DOSEMETER FOR 31 Mev BETATRON RADIATION. Thormod Henriksen (Norwegian Radium Hospital, Oslo). Acta Radiol. 49, 377-81(1958) May.

A scintillation dosimeter, employing an anthracene crystal and an RCA 931-A photomultiplier and used in connection with dose measurements of the radiation from a 31 Mev betatron is described. (auth)

11603

RESPONSE OF A SCINTILLATION PLASTIC TO CHARGED PARTICLES. M. A. Vigón Sánchez, J. Montes Ponce de León, C. E. Granados González, and R. Gutiérrez Bernal. Anales real soc. españ. fís. y quím. (Madrid) A54, 91-2(1958) Mar.-Apr. (In Spanish)

The response of a scintillation compound to incoming protons of energies between 0.2 and 1.7 Mev was studied. The monoenergetic beam of protons falls directly on the scintillation compound placed in optical contact with a photomultiplier Dumont 6292. The photomultiplier impulses drive an amplifier and an analyzer of 100 channels. The spectrum for each energy of the incoming protons was obtained. (auth)

11604

CALIBRATION OF THE CONSTANT SAGITTA METHOD FOR THE DETERMINATION OF THE MASS OF PARTICLES WHOSE RANGE IN EMULSIONS IS LESS THAN 2,000 MICRONS. J. Catala, F. Senent, and J. Aguilar. Anales real soc. españ. fís. y quím. (Madrid) A54, 101-18(1958) Mar.-Apr.

In this work a convenient technique is described to measure the mass of the slow particles of a beam by scattering measurements of tracks at the end of their range, following the constant sagitta method. Tracks of 39 protons shorter than 2000 μ were measured, and the value of $\overline{D}$ was calculated after eliminating the noise. The results obtained are in good agreement with the measurements made with protons of a longer range. (auth)

11605

RADIATION DOSIMETRY BY CHEMICAL MEANS. H. Bildstein (Österreichischen Studiengesellschaft für Atomenergie GmbH, Vienna). Atompraxis 4, 163-7 (1958). (In German)

A description is given of methods of chemical radiation dosimetry with solid, liquid, and gaseous systems of organic and inorganic substances. The possibilities of a selective dosimetry in mixed radiation fields are shown. 49 references. (auth)

11606

BASIS AND POSSIBILITIES OF FILM DOSIMETRY. K. Becker. Atompraxis 4, 168-75(1958). (In German)

In an introductory survey of the literature, the advantages of film dosimetry are discussed, followed by a brief survey of the photographic elementary process and the forms in which ionizing radiation releases energy. Then there is a discussion of the wave-length dependence of film blackening, its measurement, and methods of reducing it, i.e., emulsion technique, metal filtering, and fluorescence screens, with their advantages and disadvantages. In conclusion, the filter-analysis method of evaluation and its limitations are discussed, together with practical requirements for dosimetric films and the dosimetry of complex radiation mixtures (β and neutron dosimetry). It is concluded that the known processes all have numerous weaknesses and are not sufficiently universal in their application; however, improvements can be made. 64 references. (auth)

11607

A REGISTRATION METHOD FOR PERIODIC RAPIDLY VARYING PULSE RATES. D. Frost (Rudolf-Virchow-Krankenhaus, Berlin). Atompraxis 4, 175-7(1958). (In German)

The article describes a registration method of small inertia for impulses from radiation-measurement devices. The method can be used mainly for diagnostic examinations of the circulatory system with the help of radioactive isotopes. (auth)

11608

A METHOD FOR REDUCING AUTOABSORPTION IN β MEASUREMENTS, WITH A 4 π COUNTER. Y. Le Gallic and M. Thenard. Compt. rend. 244, 2909-12 (1957) June 12. (In French)

The use of wetting agents to increase the homogeneity of crystallization of dried samples for absolute β counting is described. Several wetting agents and salts were tried and the technique was demonstrated by determining S^{35}. (T.R.H.)

11609

A CONTRIBUTION TO THE THEORY OF THE BUBBLE CHAMBER. Yu. Kagan. Doklady Akad. Nauk S.S.S.R. 119, 247-50(1958) Mar. 11. (In Russian)

An attempt is made to explain the formation of vapor bubbles along the tracks of charged particles. The phenomenon is assumed to be the result of pre-critical nuclei passing into an area of localized energy lost by the charged particle. The energy localization area was determined using heavy particles ($\kappa = Z_0\, e^2/\hbar\, \nu \leq 1$; $Z_0 e$ – particle charge) and light molecule liquids. (R.V.J.)

11610

PROPORTIONAL COUNTER FOR MEASUREMENT OF WEAK ACTIVITIES OF SOFT β RADIATION. F. G. Houtermans and H. Oeschger (Univ. of Bern). Helv. Phys. Acta 31, 117-26(1958). (In German)

In many measuring devices the dead time is reduced by heavy shielding or by having a ring of counters connected in anticoincidence. A description is given of a proportional counter in which the anticoincidence device is built directly into the counting tube and is separated from the counting volume proper by a thin foil. The counter characteristics and the dead time were determined. Calculations for the optimal foil thickness are shown. A comparison of this counter with others shows that only the De Vries counter (Nuclear Phys. 3, 65 (1957)) has less dead time. (J.S.R.)

11611

FAST ELECTRONICS IN HIGH ENERGY PHYSICS. R. Meunier (C.E.N., Saclay, France). Ind. Atom. 2, No. 5-6, 66-78(1958). (In French)

The fundamentals on which the design of high-speed detection and coincidence circuits for high-energy physics is based are presented. (T.R.H.)

11612

THE STUDY OF NOISE PULSES AND A LIQUID SCINTILLATOR. Brat Pal Singh, H. S. Hans, and P. S. Gill (Muslim Univ., Aligarh, India). Indian J. Phys. 32, 183-91(1958) Apr.

Analysis of noise pulses of RCA photomultiplier 5819 has been made with about 350 volts between photocathode and first dynode. The differential distribution of noise pulses has been studied at different voltages and temperatures. Two distinct distributions are apparent in these curves. One has been interpreted as due to thermal noise and the other due to after-pulses caused by ion feedback. Response of stilbene in xylene liquid scintillator has been studied for Co^{60} gamma rays with high collection efficiency and at low temperature. From the differential distribution of these pulses, the Compton edge due to Co^{60} gamma rays is clearly indicated. (auth)

11613

THE PRINCIPAL PROPERTIES OF SCINTILLATION COUNTERS USING NaI(Tl) CRYSTALS. Josef Silar and Olga Novakova (Inst of Electrotechnical Physics, Prague). Jaderna energie 4, 122-7(1958) May. (In Czech.)

Study is made of main parameters of scintillation counters with NaI(Tl) crystals. The length and the slope of the scintillation detector plateau, the background, and signal to noise ratio give good reproducibility of scintillation counter measurements. These properties and the high detection efficiency, good time-resolution, and long life-time show the advantages of the scintillation counter for γ ray counting. All measurements were made with photomultipliers RCA 5819 and FEU 19 and NaI(Tl) crystals made in the Institute for Electrotechnical Physics in Prague. (tr-auth)

11614

A HIGH-TEMPERATURE FISSION CHAMBER. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 56, Session 15. J. B. Ruble and S. H. Hanauer (Oak Ridge National Lab., Tenn.). New York, American Institute of Chemical Engineers, 1958. 11p.

A pulse-type fission chamber is described for continuous use at temperatures up to 800°F. The insulator to use in such a chamber must be tested for spurious pulses as well as bulk resistivity. Data on insulator and chamber performance are presented. The chamber has a sensitivity at 800°F of 0.14 counts per second per unit thermal neutron flux. (auth)

11615

RECENT DEVELOPMENTS IN PERSONNEL RADIATION DOSIMETRY. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 94, Session 12. J. J. Fitzgerald and R. J. Feinberg (General Electric Co., Schenectady, N. Y.). New York, American Institute of Chemical Engineers, 1958. 19p.

There are many advantages associated with the use of the resonance-threshold foil neutron detector (RTF), universal ionization personnel dosimeter (UIPD), and the economical beta-gamma dosimeter (EBGD) dosimeters together with the duPont film packet 558. The EBGD may be used effectively in areas where there are no neutron exposures. The sensitivity of the EBGD is twice that of the UIPD for beta and gamma radiations. In areas where neutron exposures may be received by personnel, the UIPD and the RTF dosimeters can be effectively applied. The UIPD can also be effectively used in areas wherein only beta and gamma radiations are emitted if the loss of sensitivity is not critical and the greater versatility of the unit is more important. The RTF dosimeter can provide a rapid and sensitive method of self monitoring in critical assembly areas for control purposes. In addition, the RTF dosimeter has unique applications for emergency monitoring. The use of the duPont film packet 558 enables one with the use of the above control dosimeter to improve the sensitivity of the system by a factor of 32.5. Annual exposures of more than 0.04 r of gamma and 0.04 rad of beta radiations can be detected by processing the film on a quarterly basis. In general, the use of the RTF, the EBGD and the UIPD together with a suitably sensitive film packet such as the duPont 558 provides the means to greater radiation protection at lower operating costs. (auth)

11616

NEUTRON DETECTORS. J. Sharpe (EMI Electronics, Ltd.). Nuclear Eng. 3, 251-6(1958) June.

It is seen from the discussion that measurements of thermal neutrons present no real problems, while recent developments suggest that much of the difficulty associated with fast neutron measurements is being removed. On the other hand, the low efficiency of organic phosphors for protons of energy below 100 kev, and the pile-up in gas counters of gamma-ray events to give spurious pulses of this order of energy, coupled with the absence of convenient thresholds or resonances in the kev region, all combine to make intractable the problem of specific detection of neutrons of intermediate energy, in the presence of thermal neutrons and gamma rays. This is the outstanding problem in the field of nuclear radiation detectors and, so far as published information goes, there seems to be no solution yet in sight. (auth)

11617

SCINTILLATION COUNTING, 1958. Nucleonics 16, No. 6, 54-62(1958) June.

Progress has been made on the incorporation of heavy

elements into plastic scintillators. Organic phosphors are being investigated for neutron detection. Cathode rays were used to bombard organic substances in a study of their very short decay times. The vernier chronotron is proposed to simplify pulse timing. A design for the detection of prompt gamma photons arising from thermal-neutron capture in N^{15} is presented. Photomultiplier tubes with spherical fronts are being incorporated to decrease transit time spread. The use of arrays of scintillating rods to reveal the tracks of high energy particles is proposed. (W.D.M.)

11618

NEW FILM BADGE ENABLES CHEAPER X-RAY MONITORING. L. H. M. van Stekelenburg (National Health Research Council T. N. O., Arnhem, Netherlands). Nucleonics 16, No. 6, 83-6(1958) June.

A universal film badge that indicates x ray dose with a single reading was developed. The badge can also be used for γ rays. The badge contains two differential films. One film is shielded on both sides by 2 mm of tin, while the other is directly exposed. If appropriate films are used, there is a linear combination of their densities that is practically constant for equal radiation doses of different spectra. Response to x and γ rays of energies between 0.03 and 1.25 Mev is linear to within 20%, thus eliminating the need for film calibration. (W.D.M.)

11619

SIMPLE, INEXPENSIVE, AUTOMATIC SAMPLE CHANGER AND RECORDER. E. S. Kempner and F. A. Bisbee (Yale Univ., New Haven, Conn.). Nucleonics 16, No. 6, 87-8(1958) June.

The design of an automatic sample changer and recorder for counting radioactive samples on the surface of filter papers is presented. The samples are fixed on a large rotating drum with a G-M counter mounted vertically above the drum. The G-M tube feeds into a conventional scaler and counts continuously. (W.D.M.)

11620

CELLOPHANE DOSIMETRY FOUND UNPRECISE. Nucleonics 16, No. 6, 102(1958) June.

Initial uniformity of both thickness and optical density, effects of storage before and after irradiation, and the change of optical density with exposure to 2.5 Mev electrons was measured for green and blue cellophane. It was found that they could serve as dosimeters in the food-preservation range, but their precision is not as great at that of other dosimeters. (W.D.M.)

11621

THE ABSOLUTE DETERMINATION OF NEUTRON FLUX WITH INDIUM FOILS. Klaus Stelzer (Univ. of Frankfurt am Main). Nukleonik 1, 10-13(1958) Apr. (In German)

The γ radiation of Sn^{116} appearing as a result of the 54 min β transition of In^{116m} was used for activation measurements. The free measurements of the γ radiation from eigen absorption in the foil permitted the effect of the neutron absorption in the foil to be detected, while in the measurement of the β activity it was concealed by the strong eigen absorption of the foil β radiation. The determination of the activation current and the β eigen absorption factor was simplified, and an accurate measurement of the mass charge of the thinnest foil is possible. (tr-auth)

11622

RADIATION MONITOR WITH SCINTILLATION COUNTER OF TYPE 58 NO. 1. S. Wojtowicz and P. Zupranski (Inst. of Nuclear Research). Nukleonika 3, 237-42 (1958). (In Polish)

Design and operation of a scintillation counter for neutron radiation monitoring are described. (R.V.J.)

11623

A POCKET DOSIMETER WITH AN ALARM SYSTEM FOR DOSES EXCEEDING 25 mr. A. Wasilewski (Inst. of Nuclear Research). Nukleonika 3, 242-4(1958). (In Polish)

Design and performance of a γ pocket dosimeter are described. (R.V.J)

11624

TIME-OF-FLIGHT MEASUREMENT OF PHOTONEUTRON ENERGY SPECTRA. W. Bertozzi, F. R. Paolini, and C. P. Sargent (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 110, 790-1(1958) May 1.

A technique has been developed for measuring photoneutron energy spectra which makes use of the time-of-flight principle and a linear accelerator as a pulsed source of bremsstrahlung. Electrons from the linear accelerator impinge on a target at a repetition rate of 120/sec. The pulses have a duration of 2.5×10^{-9} sec, which is controlled by the conduction time of an electron gun in the Van de Graaff injector. The interval of time is measured between the passage of the bremsstrahlung through a plastic scintillator near the (γ,n) target and the detection of a neutron in another plastic scintillator located at the end of a seven-meter flight path, 120° to the path of the bremsstrahlung beam. The elapsed time spectrum is converted to a pulse-height spectrum which is analyzed into 256 channels. (A.C.)

11625

ELECTRONIC COMPUTER FOR MASS IDENTIFICATION OF PARTICLES. William L. Briscoe (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 29, 401-4(1958) May.

A circuit for identifying protons, deuterons, and tritons is described. The identification is accomplished by obtaining the product of the energy and the initial space rate of energy loss. The product is modified so that each type of particle gives a unique result in the form of an output pulse having an amplitude nearly proportional to the mass of the particle. The circuit as given is capable of handling input pulses as narrow as 1 μsec, although shorter pulses may be used if some test features are eliminated. The multiplying operation is performed by QK-329 tubes, using the principle of difference of squares. (auth)

11626

EFFICIENCIES OF SODIUM IODIDE CRYSTALS. A. L. Stanford, Jr. and W. K. Rivers, Jr. (Georgia Inst. of Tech., Atlanta). Rev. Sci. Instr. 29, 406-10(1958) May.

Efficiencies for monoenergetic gamma rays, emanating from an axial point source and incident on sodium iodide crystals of 1.5 in. diameter and of various heights, have been calculated by numerical integration methods. The crystals considered are right circular cylinders of heights 0.125, 0.25, 0.375, 0.50, 0.75, 1.5, 2.0, and 3.0 in. Seventeen photon energies in the range from 0.025 to 10.0 Mev were used. Fourteen distances from source to crystal face in the range 0.1 to 50.0 cm were used. Efficiencies for crystals of diameters other than 1.5 in. may be obtained from these results. Relative photoelectric efficiencies were not calculated. (auth)

11627

PHOTOPROTON SCINTILLATION SPECTROMETER. A. Whetstone, B. Allison, E. G. Muirhead, and J. Halpern (Univ. of Pennsylvania, Philadelphia). Rev. Sci. Instr. 29, 415-19(1958) May.

An apparatus is described for the measurement of the energy and angular distribution of protons from (γ, p) reactions. A method is presented for obtaining energy spread of 3% for protons of 3 to 15 Mev with a NaI scintillator of 1-in. diam aperture. Energy calibration of the detector with monoenergetic protons gives an energy vs pulse-height line having an intercept of 0.46 ± 0.10 Mev. The ratio of α particle to proton energy for equal pulse heights is found to be 1.93 ± 0.04 for 4.48-Mev α particles. A CsI scintillator, similarly mounted, yields an intercept of −0.17 ± 0.15 Mev and an α-proton energy ratio of 1.66 ± 0.07 for 5.3-Mev α particles. A modification of the phoswich to provide discrimination against electrons is described. (auth)

11628

ON THE ELECTRIC SWEEPING FIELD IN A DIFFUSION CLOUD CHAMBER. N. D'Angelo (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 29, 433-4 (1958) May.

A diffusion chamber in a lead housing was operated at the Argonne CP-5 reactor with a gamma background of 0.1 to 0.2 mr/hr. It was found not only desirable but necessary to have a steady voltage ≥ 20 v between top and bottom of the chamber, with the top negative. Under these conditions the chamber worked with a sensitive region more than 2 in. deep and fairly sharp tracks. With the top positive, the same voltage did not provide satisfactory operation, the chamber being almost completely fogged. The two possible explanations of this were investigated. (W.D.M.)

11629

HIGH-INTENSITY PULSED MAGNET FOR HYPERON DETECTION. R. A. Schluter (Massachusetts Inst. of Tech., Cambridge). Rev. Sci. Inst. 29, 434-5(1958) May.

A pulsed-magnet system operating at 150 to 200 kilogauss which has been used for detection of sigma hyperons in conjunction with nuclear emulsion is described. The magnet design is more strongly molded by the requirements of aperture, absence of background scattering, and repetitive, reliable operation than by an aim to attain the highest possible field. Design and performance of the coil are discussed. (W.D.M.)

11630

WAVELENGTH-SHIFTER EFFICIENCIES FOR NOBLE GAS SCINTILLATORS. John A. Northrop (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 29, 437-8 (1958) May.

Measurements of the relative efficiencies of several organic wavelength shifters for alpha-particle scintillations in xenon, krypton, and argon are reported. (W.D.M.)

11631

THE MEASUREMENT OF THE UNWANTED BREMSSTRAHLUNG IN A 35-Mev BETATRON. Wolfgang Pohlit (Max Planck-Inst. für Biophysik, Frankfurt/Main). Strahlentherapie 106, 149-54(1958). (In German)

By means of small condenser-ionization chambers, the distribution of unwanted bremsstrahlung within the medical irradiation space of a 35 Mev-betatron is measured and the quality of the radiation is determined by lead absorption curves at different points of the space. These data were the basis for rational procedures aiming at far-reaching elimination of this component of unwanted radiation, so that the doses administered within the patient is reduced to about 0.4% of the tumor doses. (auth)

11632

RECENT DEVELOPMENT OF SCINTILLATION COUNTERS. W. Hanle and H. Schneider (Univ. of Giessen, Germany). Z. angew. Phys. 10, 228-48(1958) May. (In German)

A survey is presented of the developments of scintillation detectors. 242 references. (J.S.R.)

11633

PHOTOGRAPHIC DETECTION OF DENSE SHOWERS OF CHARGED PARTICLES. I. D. Rapoport (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 34, 999-1000(1958) Apr. (In Russian)

11634

DETERMINATION OF IONIZING PARTICLE VELOCITIES BY GAGING THE TRACKS WITH HIGH FREQUENCY ELECTRIC FIELDS. G. A. Askar'yan (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 1005-7(1958) Apr. (In Russian)

An elementary theory is suggested for measuring the ionic density of tracks, and an equation is developed for gaging the tracks of fast particles. Various means are offered for improving the effectiveness of the method. (R.V.J.)

11635

NUCLEAR RADIATION DETECTION. William J. Price. New York, McGraw-Hill Book Company, Inc., 1958. 389p. $9.00.

As the study of nuclear radiation detection requires an understanding of the interaction of radiation with matter, the first chapter covers the essential aspects of that subject. The term detection, as used in this book, refers not only to the detection of radiation, but also to the measurement of the amount and energy. Each detector, therefore consists of two parts: a detector and a measuring device. The classification and characterization of radiation detection instruments are surveyed, and the statistical nature of detection systems is discussed for pulse-type counters and for mean-level detection systems. The importance of ionization chambers, the Geiger-Mueller counter, proportional counters, and scintillation detectors required detailed treatment in a separate chapter on each. Other detection systems, such as nuclear emulsion techniques, cloud chambers, crystal counters, Cherenkov detectors, electron multipliers, chemical dosimeters, and calorimetric methods are considered in a less detailed manner. Because of the special characteristics of neutrons and the importance of neutron measurements a special chapter is devoted to this subject. The final chapter offers a detailed treatment of the electronic apparatus associated with radiation detection instruments with special emphasis on electronic circuits for use with pulse-type detectors. (J.S.R.)

Mesons

Refer also to abstract 11988.

11636 NP-6782

Princeton Univ., N. J. Palmer Physical Lab., and Naval Ordnance Lab., [White Oak, Md.].

A CLOUD CHAMBER INVESTIGATION OF NEUTRAL STRANGE PARTICLES. Technical Report No. 19. Judson Hardy, Jr. June 2, 1958. 89p. Contract Nonr-1858-(06).

The total cross sections for production of λ and θ^0 by protons and pions as a function of the mass number of the target nucleus are given. These cross sections were measured by injecting a known number of 1.5-Bev pions and a known number of 2.7 Bev protons into a cloud

chamber containing plates of carbon, iron, and lead and determining in each case the number of λ and θ^0 particles produced. The lifetime of θ_2^0's were measured by determining the number of decays at two distances from the source of the beam thereby getting two points on the survival exponential curve. (W.D.M.)

11637 UCRL-8202 and Suppl.

California. Univ., Berkeley. Radiation Lab.

POSITRON SPECTRUM FROM THE DECAY OF THE μ MESON. Walter F. Dudziak, Ryokichi Sagane, and James Vedder. Mar. 20, 1958. 69p. Supplement. Walter F. Dudziak. June 3, 1958. 12p. Contract W-7405-eng-48. $1.75(OTS), UCRL-8202 and $0.50 (OTS), UCRL-8202(Suppl.).

This report and supplement were issued separately, but are cataloged as a unit.

A magnetic spiral-orbit spectrometer was used to study the positron spectrum from an isotropic μ^+ decay. The positrons were identified by an electronic technique designed to measure the lifetime of the muon. The measured weighted mean value of the μ^+ mean life is 2.210 ± 0.015 μsec. The data were analyzed according to the simplified one-parameter theory of Michel, as modified to include radiative corrections. The value of this parameter is $p_m = 0.741 \pm 0.022$. The value of the maximum positron energy was W = 52.87 ± 0.07 Mev. From this value and the simple algebraic relation to the masses of the decay particles values of μ = 206.94 ± 0.27 and of 8 emu (upper limit) for the neutral particle are derived. (W.D.M.)

11638 NP-tr-90

THE MULTIPLE PRODUCTION OF STRANGE PARTICLES. V. S. Barashenkov. Translated from a publication of the Joint Institute for Nuclear Research U.S.S.R. 1957. 9p. (Translation partially illegible.)

Reported at the International Conference in Padova-Venezia, September 22-28, 1957.

The multiple production of strange particles in (NN) and (πN) collisions with energies in the Bev range was studied. Calculations were made taking into account the conservation of energy, isotopic spin, strangeness, and baryon number. (W.D.M.)

11639

MU-MESON SCATTERING FROM LEAD NUCLEI. A. W. Adey and W. J. Heikkila (Defence Research Telecommunications Establishment, Defence Research Board, Ottawa, Ont., Can.). Can. J. Phys. 36, 801-4 (1958) June.

Negative μ-mesons of 23-Mev energy were scattered from a 0.022 in. lead plate mounted in a propane bubble chamber. The angular scattering distribution observed has been compared to an estimate based on Molière's multiple scattering theory and was found to be in good agreement. (W.D.M.)

11640

PARITY VIOLATION AND THE POLARIZATION OF NUCLEONS FROM HYPERON DECAY. J. Leitner (Duke Univ., Durham, N. C.). Nuovo cimento (10) 8, 68-73(1958) Apr. 1.

A general expression for the polarization of nucleons from hyperon decay is obtained. It is shown that this polarization is purely longitudinal in the rest frame of the hyperon. Such longitudinal polarization will have a component transverse to the nucleon momentum in the laboratory system and is thus detectable by means of nuclear scattering. (auth)

11641

ON THE DECAY MODES OF INTERACTING AND NON-INTERACTING K^+-MESONS. B. Bhowmik, D. Evans, and D. J. Prowse (Univ. of Bristol, Eng.) and F. Anderson, D. Keefe, and A. Kernan (Univ. Coll., Dublin). Nuovo cimento (10) 8, 147-54(1958) Apr. 1.

The decay modes of K^+ mesons which have been inelastically scattered from nuclei in emulsion have been determined, and it is shown that their relative frequencies are consistent with those obtained for K^+ mesons which have not undergone nuclear interaction. Measurements were also made on a total of 286 decay events with a singly charged secondary with the object of discovering without detection bias particles decaying in the rare τ′ and the K_{μ_3} modes. (auth)

11642

RADIATIVE β-DECAY OF THE π-MESON. E. Ferrari (Univ. of Rome and Istituto Nazionale di Fisica Nucleare, Rome). Nuovo cimento (10) 8, 155-9(1958) Apr. 1.

The probability of the process $\pi \rightarrow e + \nu + \gamma$ is calculated by means of a cut-off procedure. It is shown that for ST coupling the branching ratio $(\pi \rightarrow e + \nu + \gamma)/(\pi \rightarrow \mu + \nu)$ is practically independent of the cut-off parameter. (auth)

11643

NUCLEAR POTENTIAL FOR τ^+-MESONS. T. G. Lim and S. J. Bosgra (Univ. of Amsterdam). Nuovo cimento (10) 8, 340-4(1958) Apr. 16.

An analysis of the elastic scattering of τ^+-mesons in G5 nuclear emulsion shows that the nuclear potential by which the τ^+-mesons are scattered is repulsive and that its value is higher than 13 Mev. (auth)

11644

ISOTOPIC PROPERTIES OF THE K-MESON DECAY INTERACTION. R. F. Sawyer (Harvard Univ., Cambridge, Mass.). Nuovo cimento (10) 8, 350-1(1958) Apr. 16.

The weak interaction responsible for θ decay was investigated for properties which would forbid θ^+ decay and account for the branching ratio $\tau/\tau = 4$, as would $\Delta T = \frac{1}{2}$. (T.R.H.)

11645

ON THE COUPLING BETWEEN (Λ^0, p) FIELD AND THE K-MESON FIELD. E. M. Ferreira (Imperial Coll., London). Nuovo cimento (10) 8, 359-60(1958) Apr. 16.

Calculations are made in connection with the possibility of Λ^0 decay into 3 fermions proceeding through the interaction with the K-meson field, that is, $\Lambda^0 \rightarrow p + K \rightarrow p + \mu + \nu$, the intermediate state being a virtual one. (T.R.H.)

11646

Λ–NUCLEON POTENTIAL FROM HYPERFRAGMENT DATA. Marc Ross (Indiana Univ., Bloomington) and D. B. Lichtenberg (Physikalisches Staatsinstitut, Hamburg). Phys. Rev. 110, 737-42(1958) May 1.

The volume integrals of the Λ–nucleon potentials in the triplet and singlet spin states are deduced from hyperfragment binding-energy data. The effects of tensor forces are neglected in the calculation but are discussed qualitatively. Results are sensitive to the sizes and shapes of the nuclei in which the Λ is bound, but are not very sensitive to Λ binding energies. Results also depend on the range of the Λ-nucleon potential and on the spin configurations of the nuclei. Within the approximations made, the Λ–nucleon potentials are consistent with experiment and agree with theoretical potentials due to pion exchange. A crude determination of the Λ–nucleon potential from the observed lifetime for mesonic decay of hyperfragments is consistent with the binding-energy determination. (auth)

11647

SCATTERING OF K^+ MESONS BY NUCLEONS. Saul Barshay (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 110, 743-7(1958) May 1.

A calculation of the scattering of low-energy (≤50 Mev) K^+ mesons by nucleons via the mechanism of a boson-boson interaction between two pions and two K mesons is presented. The following experimentally observed features of the low-energy scattering seem to be simply represented by the scheme: (a) The scattering is predominantly in the S wave and the cross section shows a slight rise with increasing energy. (b) The effective nuclear potential is repulsive and of relatively short range ($\sim 1/2\mu$). (c) The charge exchange scattering is very small at very low energies. A preliminary discussion of the scattering at higher energies is given by introducing, in addition, the "direct" scattering via the interactions of K mesons with nucleons and hyperons. (auth)

11648

PRODUCTION OF K MESONS AND HYPERONS IN HYDROGEN BY 1.95-Bev PROTONS. Robert Lea, Earle C. Fowler, and Henry L. Kraybill (Yale Univ., New Haven, Conn.). Phys. Rev. 110, 748-50(1958) May 1.

A search has been made for K mesons and hyperons produced by a well-collimated beam of 1.95-Bev protons in a hydrogen-filled diffusion chamber. One case of associated production was observed, which is interpreted as $p + p \rightarrow \Lambda^0 + K^+ + p$. In a total track length of 2.4×10^5 g/cm^2 of hydrogen, no other hyperons or K mesons were observed to be produced. It is concluded that the cross section for production of K mesons and hyperons is probably less than 0.4 mb. (auth)

11649

MULTIPLE PRODUCTION OF PIONS IN NUCLEAR COLLISIONS. Prem Prakash Srivastava (Tufts Univ., Medford, Mass.) and George Sudarshan (Univ. of Rochester, N. Y.). Phys. Rev. 110, 765-6(1958) May 1.

The statistical theory of meson production in nuclear collisions is given a fully covariant formulation. A single parameter of the dimensions of a mass appears in the theory, which is normalized by matching a single experimental number. Numerical results for various processes are presented. A simple recurrence relation between the covariant phase-space integrals greatly facilitates the computations. (auth)

11650

CROSS SECTIONS FOR DOUBLE AND TRIPLE MESON PRODUCTION IN HYDROGEN BY PHOTONS WITH ENERGIES UP TO 1 Bev. J. M. Sellen, G. Cocconi, V. T. Cocconi, and E. L. Hart (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 110, 779-80(1958) May 1.

Diffusion cloud chamber pictures taken at the Cornell synchrotron were analyzed for the three-pronged events ascribable to multiple meson production. The results concerning cross sections are reported. (A.C.)

11651

LIFETIME AND DECAY OF THE K_2^0 MESON. M. Bardon, M. Fuchs, K. Lande, and L. M. Lederman (Columbia Univ., New York and Brookhaven National Lab., Upton, N. Y.); W. Chinowsky (Brookhaven National Lab., Upton, N. Y.) and J. Tinlot (Univ. of Rochester, N. Y. and Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 110, 780-2(1958) May 1.

The lifetime of the K_2^0 meson has been determined by comparing the yield of K_2^0 decays in two exposures which differ by a factor of four in mean flight time from production target to detector. An earlier short-distance exposure established the existence of long-lived neutral particles in the secondary radiation from a target in the Brookhaven Cosmotron. The observations established limits on the mean life: 4×10^{-9} sec $\tau < 10^{-6}$ mc. Subsequently, the observed lack of anomalous K^0 decays in bubble chamber studies of V-particle production in n-p collisions set a limit $\tau > 3 \times 10^{-8}$ second. An estimate of the K_2^0 lifetime can be obtained from the known K^+ branching ratios and lifetime by application of charge independence and the $\Delta T = \frac{1}{2}$ selection rule. This leads to an estimated K_2^0 lifetime of $\tau \sim 5 \times 10^{-8}$ second. (A.C.)

11652

TIME-REVERSAL INVARIANCE AND Θ_2^0 DECAY. Steven Weinberg (Columbia Univ., New York). Phys. Rev. 110, 782-4(1958) May 1.

11653

PHOTOPRODUCTION OF K MESONS AND THE INTRINSIC PARITIES OF THE STRANGE PARTICLES. B. T. Feld and G. Costa (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 110, 968-73(1958) May 15.

The general properties near threshold are examined of the reactions γ + nucleon → hyperon + K meson, especially from the point of view of using these reactions to determine the intrinsic Y–K parity relative to that of the nucleon from which they are produced. Computations are based on the possibility that, unlike the pion case, there may be no enhancement of the interaction in some special state. Alternatively, departure of the observations from the predictions of such considerations will point out the importance of enhanced states. The approach is through a perturbation computation which uses a simple model of the Yukawa interaction in order to exhibit in explicit form the dependence of the reaction properties on the hyperon and K-meson moments and on the nature of their interaction. In general, it is pointed out how observations on angular distributions must be combined with relative cross sections and their energy dependence in order to draw unambiguous conclusions. (auth)

11654

STATISTICS OF Pi MESONS. Billy S. Thomas and Wendell G. Holladay (Vanderbilt Univ., Nashville). Phys. Rev. 110, 981-4(1958) May 15.

By analyzing the decay of the τ^+ meson, evidence for the boson character of π^+ mesons is obtained which is independent of the Pauli relation between spin and statistics. The usual Dalitz-Fabri expansion in angular momentum eigenfunctions is made, with the important difference that only antisymmetric states are allowed for the two like pions. The matrix elements and π^- distributions are calculated and the latter are compared with the data from 481 τ^+ decay events by using χ^2 to test the statistical significance of each hypothesis about the spin and parity of the final state. If parity is conserved in the decay, then no reasonable fit can be obtained for any spin less than 4. If parity is not conserved, then no reasonable fit can be obtained for any spin less than 3. Thus, if the τ spin is less than 3, π^+ mesons obey Bose statistics. This result is independent of any assumption about invariance under time reversal. (auth)

11655

CONSEQUENCES OF A PSEUDOVECTOR PION-NUCLEON COUPLING AND THE UNIVERSAL β DECAY. R. E. Norton and W. K. R. Watson (California Inst. of Tech., Pasadena). Phys. Rev. 110, 996-7(1958) May 15.

An explicit calculation of the finite ratio of renormalization coefficients is being undertaken by means of dispersion theory so that a value for μ_0 may be obtained.

Preliminary estimates based upon perturbation theory indicate a bare pion mass in the neighborhood of 200 m_e. (W.D.M.)

11656

π^+ PRODUCTION IN CARBON BY 308 Mev π^- MESONS. V. V. Krivitskii and A. A. Reut. Soviet Phys. (Doklady) 2, 24-6(1957) Jan.-Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 6485.

11657

PHASES OF MESON-NUCLEON SCATTERING UP TO 310 Mev. A. I. Mukhin, I. V. Popova, and G. N. Tentyukova. Soviet Phys. (Doklady) 2, 27-9(1957) Jan.-Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 6486.

11658

π^0 PHOTOMESON PRODUCTION ON COMPLEX NUCLEI. A. S. Belousov, E. I. Tamm, and E. V. Shitov. Soviet Phys. (Doklady) 2, 90-2(1957) Jan.-Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 8100.

11659

ON POSSIBLE DIPOLE TRANSITIONS OF Λ-PARTICLES. B. L. Ioffe and I. Ya. Pomeranchuk. Soviet Phys. (Doklady) 2, 202-5(1957) Mar.-Apr.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 10198.

11660

ANGULAR CORRELATIONS OF $\pi^+ - \mu^+ - e^+$-DECAYS IN A PROPANE BUBBLE CHAMBER. V. V. Barmin, V. P. Kanavets, B. V. Morozov, and I. I. Pershin. Zhur. Eksptl' i Teoret. Fiz. 34, 830-5(1958) Apr. (In Russian)

Results of 6760 $\beta^+ - \mu^+ - e^+$-decay events photographed in a two liter propane bubble chamber are considered. Assuming the angular distribution of decay positrons to be described by the formula $1 + a \cos\theta$ it is found that $a_{prop} = -0.19 \pm 0.03$. This result confirms Lee and Yang's hypothesis of nonconservation of parity in weak interactions. (tr-auth)

11661

STRANGE PARTICLE DECAYS IN THE FEYNMAN AND GELL-MANN THEORY. I. Yu Kobzarev and I. E. Tamm (Lebedev Inst. of Physics, Academy of Sciences, USSR.). Zhur. Eksptl'. i Teoret. Fiz. 34, 899-901(1958) Apr. (In Russian)

An explanation is proposed for the equal probability of K_{e3} and $K_{\mu 3}$ decays in the absence of K_{e2} decay and also for the large asymmetry observed in the decay of polarized hyperons. A universal A-V Gell-Mann and Feynman interaction is assumed. (tr-auth)

11662

ON THE RELATIONS BETWEEN THE CROSS SECTIONS FOR MULTIPLE PRODUCTION OF π-MESONS. N. V. Dushin (Leningrad Polytechnic Inst.). Zhur. Eksptl'. i Teoret. Fiz. 34, 916-21(1958) Apr.

Isotopic relations were obtained between the cross sections of transformation of a π-meson and a γ-quantum into three π-mesons during collisions between the π-meson or γ-quantum and nucleons or deuterons. It is shown that near the threshold of the reaction and also for the formation of π-mesons with identical momenta some auxiliary relations hold. (tr-auth)

11663

TIME REVERSAL AND POLARIZATION PHENOMENA IN REACTIONS INVOLVING γ-QUANTA. L. I. Lapidus (Joint Inst. of Nuclear Studies). Zhur. Eksptl'. i Teoret. Fiz. 34, 922-30(1958) Apr. (In Russian)

Polarization phenomena in the photoproduction and radiative capture of pions as well as in the Compton effect are considered. Consequences of invariance under time reversal are investigated. Wolfenstein's theorems are extended to the case when the reactions under consideration involve γ-quanta. (tr-auth)

11664

DEPOLARIZATION OF μ MESONS IN HYDROGEN. S. S. Gershtein (Inst. of Problems in Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 993-4(1958) Apr. (In Russian)

Collisions of μ mesons with the H_2 molecule were studied using a method analogous to that suggested by Fermi for the calculation of slow neutron scattering by molecules. The results confirmed a previous assertion on the complete depolarization of μ meson in hydrogen. (R.V.J.)

11665

ON DETERMINATION OF K MESON PARITY. L. B. Okun and I. Ya. Pomeranchuk. Zhur. Eksptl'. i Teoret. Fiz. 34, 997-8(1958) Apr. (In Russian)

An experiment for the determination of sign $P_K P_N P_\Lambda$ is analyzed. (R.V.J.)

11666

ON THE CROSS SECTION OF π-MESON-NUCLEON INTERACTIONS AT HIGH ENERGIES. P. B. Begzhanov (Inst. of Physics, Academy of Sciences, Armenian SSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 1013-14(1958) Apr. (In Russian)

Calculations were made of the cross sections for inelastic interactions and nuclear opacity using the uniform smoothed nuclear model and based on experimental data from π-meson interactions with graphite and lead at 0.9 to 34 Bev. The cross section magnitudes obtained, $\sigma_\pi = 33 \pm 4$ mb, are in good agreement with the magnitudes obtained from direct measurements. It was observed that at energies above 1.9 Bev the cross sections of π-meson interactions do not vary with energies up to 34 Bev. The data indicate that the nuclear and electromagnetic nuclear radii coincide when uniform smoothed distribution is used. (R.V.J.)

11667

ON THE INTERACTIONS OF K MESONS, PIONS, NUCLEONS, AND HYPERONS. V. S. Barashenkov (Joint Inst. of Nuclear Studies). Zhur. Eksptl'. i Teoret. Fiz. 34, 1016-17(1958) Apr. (In Russian)

11668

EMISSION OF Λ^0 PARTICLES IN K MESON CAPTURE BY NUCLEI IN PHOTOEMULSION. S. A. Bunyatov, A. Vrublevskii, D. K. Kopylova, et al. (Joint Inst. of Nuclear Studies). Zhur. Eksptl'. i Teoret. Fiz. 34, 1028-30(1958) Apr. (In Russian)

Three cases of Λ^0 decay were found in the immediate vicinity of σ_k stars when a stack of Ilford G-5 emulsion plates (600 μ each) was exposed in the Berkeley bevatron. An attempt was made to establish a correlation between the initial events and the decay of Λ^0 particles. Thirteen initial events were found; the results and analysis are presented. (R.V.J.)

Meteorology

11669 SCTM-243-54(51)

Sandia Corp., Albuquerque, N. Mex.

THE VARIABILITY OF ATMOSPHERIC PRESSURE.

B. N. Charles. Oct. 22, 1954. Changed from OFFICIAL USE ONLY June 11, 1958. 27p. Contract [AT(29-1)-789]. $6.30(ph OTS); $3.00(mf OTS).

Maps and tables are presented showing mean daily D-values and their standard deviations in feet, at sea level, the 700-mb, and the 500-mb levels. The effect of altitude upon the standard deviation of daily D-value, and the annual average values over North America up to altitudes of about 50,000 ft are considered. (auth)

11670 SCTM-302-57-(51)
Sandia Corp., Albuquerque, N. Mex.
THE U. S. WEATHER BUREAU-SANDIA CORPORATION CO-OPERATIVE PROJECT IN CLIMATOLOGY. Final Report: Upper-Wind Statistics from USWB-FCDA Data. B. N. Charles. Dec. 9, 1957. 16p. Contract AT(29-1)-789. $3.30(ph OTS); $2.40(mf OTS).

Upper-air wind soundings collected once-daily above 51 stations, mostly in North America, over a five-year period were analyzed statistically. The computations include seasonal, meridianal, vector winds and wind shears and their standard deviations, Mauchly ellipticity statistics, correlations between winds separated in time and space, and vertical relationships of wind as shown by contingency tables. The resulting 6000 pages of tabulations are bound separately. (C.H.)

Molecular Properties

11671 AEC-tr-3263
STUDY OF MOLECULAR DICHROISM BY MEANS OF AN ARTIFICIAL ORIENTATION OF THE MOLECULES. L. V. Smirnov (Smirnev). Translated for Los Alamos Scientific Lab. from Optika i Spectroskopiya 3, 123-33 (1957). 16p.

The general and most frequently encountered special cases of the relationship between oriented sheet dichroism and intrinsic molecular dichroism are presented. The ratios obtained are used for the determination of the polarization of π-electron transitions in absorption of certain pigments including chrysophenine, brilliant yellow, and congo red. (auth)

11672
ON THE PROBABILITY OF ELECTRON CAPTURE BY NEUTRAL ATOMS IN TRIPLE COLLISIONS. Iu. S. Saiasov (Inst. for Chemical Physics, Academy of Sciences, USSR). Soviet Phys. (Doklady) 2, 147-8(1957) Mar.-Apr.

The electron capture coefficient α cm^6/sec (sic) in the process $e + H + H_2 = H^- + H_2$ is calculated from the cross sections for $H^- + H_2 = H + H_2 + e$. A table of values for α is presented for different temperatures of the third particle H_2. (J.S.R.)

11673
ELECTRON PARAMAGNETIC RESONANCE OF V^{3+} ION IN CORUNDUM. G. M. Zverev and A. M. Prokhorov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 34, 1023-4(1958) Apr. (In Russian)

The electron paramagnetic resonance spectrum of V^{3+} ions in corundum monocrystal Al_2O_3 was investigated. Observations were made of the V^{3+} ion line at T = 4.2°K and frequencies of 14,000 to 38,000 m hertz. The line intensity diminished when the temperature was lowered to 2°K or raised to 77°K. The line consisted of eight equidistant components corresponding to the nuclear spin magnitude for V^{51} of $I = 7/2$. The line was in parallel orientation when the magnetic field was parallel to the crystal axis Z, however it expanded and disappeared when the crystal was turned at 60° to the parallel orientation. Measurements of the line intensities at various temperatures show that D > O and has a magnitude of ~ 10 cm^{-1}. (R.V.J.)

Neutrons

11674 AECU-3758
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
A MONTE CARLO STUDY OF NEUTRON THERMALIZATION. H. D. Brown. [1957]. 22p. Contract AT(07-2)-1. $4.80(ph OTS); $2.70(mf OTS).

The slowing down of neutrons from fission to absorption energies in a homogeneous medium has been treated by a Monte Carlo method. Thermalization by elastic collisions in both light and heavy water was computed on an IBM-650. One-sixth the mean-square distance travelled by the neutrons was interpreted as the migration area. This quantity was analyzed to give the age, τ, both above and below the indium resonance and the thermal diffusion constant, D, as functions of the moderator temperature, the effective moderator mass, the moderator composition, the scattering and absorption laws, and the energy distribution of the neutron source. The migration area from the fission energy source to below the indium resonance energy (1.46 ev) was found to be 27.4 cm^2 for H_2O and 120 cm^2 for D_2O. By varying the absorption cross section, the migration area from the indium resonance energy to absorption of the neutrons could be decomposed into components D/L^2 and τ_s. D and τ_s were found to be 0.19 cm and 0.77 cm^2, respectively, for H_2O, and 0.87 cm and 20 cm^2 for D_2O. D was found to increase with the thermal agitation of the moderator at the rate of 0.15%/°C for H_2O and 0.14%/°C for D_2O. Neutron energy distributions found from the scattering frequency agree with those derived by analytical methods. (auth)

11675 NYO-8056
Rochester, N. Y. Univ.
ASYMMETRY MEASUREMENTS IN THE SCATTERING OF 155 MEV NEUTRONS BY CARBON, ALUMINUM, COPPER, CADMIUM AND LEAD. Robert S. Harding. Feb. 7, 1958. 134p. Contract AT(30-1)-875. $21.30 (ph OTS); $6.90(mf OTS).

The asymmetry in the scattering of a 13% polarized neutron beam from C, Al, Cu, Cd and Pb was measured at angles below the first maximum in the asymmetry. The scattered neutrons were detected by a large volume scintillator with an energy threshold determined by pulse height discrimination. An effective energy of the polarized neutron beam for a detection threshold of 100 Mev was determined by an attenuation measurement to be 155 ± 5 Mev. A value of 0.130 ± 0.013 for the polarization of the primary neutron beam was found by a method which neglects the energy difference between the first and second scatterings. The interaction of the neutron magnetic moment with the coulomb field of the nucleus is evidenced by a depression of the polarization at small angles in the heavy elements. Optical model calculations were performed by a W.K.B. phase shift analysis to find the "best fit" to the 155 Mev p-carbon polarization data from Uppsala. The assumed nuclear potential consisted of a real, inverted spin-orbit potential in addition to a complex central potential with a Woods and Saxon type of radial distribution. The nuclear parameters giving a reasonable fit to the p-carbon data were used to calculate neutron polarization curves by W.K.B. and Born approximation for comparison with the data of this experiment. The

nuclear parameters determined by the W.K.B. phase shift analysis of the large angle polarization data provide reasonable agreement between calculated and experimental neutron polarization data but do not provide quantitative agreement between calculated and experimental cross sections. (auth)

11676 TID-7547
Columbia Univ., New York.
THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. W. W. Havens, Jr., ed. 291p. $3.25(OTS).

Papers are presented on the following subjects: present status of measurements, low-energy neutron spectroscopy, interpretation of low-energy neutron spectroscopy, neutron interactions with fissionable nuclei, fission physics, fast neutron cross sections, and neutron capture gamma rays. Separate abstracts have been prepared for each paper. (M.H.R.)

11677 TID-7547(p.3-9)
Cornell Univ., Ithaca, N. Y.
PRESENT STATUS OF NEUTRON INTERACTIONS WITH NUCLEI. H. A. Bethe. p.3-9 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 7p.

The fact that nearly all neutron reactions go according to the compound model of the nucleus is emphasized. The cloudy crystal ball model is presented as the most correct picture. The development of this model is traced. The statistical model and the dispersion region of the disintegration of the compound nucleus are reviewed. Some information is given on direct interactions. (M.H.R.)

11678 TID-7547(p.9-13)
Brookhaven National Lab., Upton, N. Y.
NUCLEAR INFORMATION OBTAINABLE FROM LOW ENERGY NEUTRON SPECTROSCOPY. D. J. Hughes. p.9-13 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 5p.

The validity of experimental nuclear data for use by the theoretician is discussed. A few cases are considered for which there is an abundance of information but where a great deal of care must be exercised in producing valid sets of data for use in constructing and testing nuclear models. Some thermal neutron cross sections at the low-energy end of the resonance region which need careful work are mentioned briefly. The question of the level spacing distribution, the strength function, and the question of potential scattering and its relation to the nuclear radius are discussed. (M.H.R.)

11679 TID-7547(p.14-18)
Los Alamos Scientific Lab., N. Mex.
THE PRESENT STATUS OF MEASUREMENTS OF THE FAST NEUTRON CROSS SECTION. R. F. Taschek. p.14-18 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 5p.

The status of neutron cross sections in the energy range 1 kev to 25 Mev is discussed. Those areas of research of interest to applied and/or theoretical work are considered where either almost no measurements exist or no methods of measurement exist. The areas considered are: absolute flux determination, fast neutron fission cross sections, elastic scattering and non-elastic collision cross sections gamma-ray spectrum following fast neutron interaction, (n,2n), (n,p), (n,α) reactions, and neutron source technology. (M.H.R.)

11680 TID-7547(p.19-27)
Columbia Univ., New York.
RESULTS OBTAINED WITH THE HIGH RESOLUTION NEVIS SYNCHROCYCLOTRON NEUTRON VELOCITY SPECTROMETER. J. Rainwater, J. S. Desjardins, J. Rosen, W. W. Havens, Jr., and E. Melkonian. p.19-27 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 9p.

The velocity selector system developed for use with the 400-Mev Nevis synchrocyclotron is described. The basic r-f varies between 28 and 18 Mc with a modulation frequency of about 60/sec. Since all the beam strikes the target in 0.1 μsec, the intensity of the neutron burst is of the order of 10^{18}/sec. Using a 128-channel timing system, measurements were made on Ta, Ag, U^{238}, and Cd. A block diagram of the control system, the geometry of the system and the collimation used, and the geometry of the detector are shown. (M.H.R.)

11681 TID-7547(p.27-30)
Columbia Univ., New York.
COMPUTING MACHINE METHODS OF HANDLING NEUTRON VELOCITY SPECTROMETER DATA. E. Melkonian and W. W. Havens, Jr. p.27-30 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 4p.

The method of reading out the contents of the 2000-channel analyzer is described briefly. The data are punched out on about a hundred feet of paper tape for each run, taking about three and one-third minutes. As a distinct operation, the information on paper tape can be transferred to punched cards while another run is in progress. Since generally automatic plotting of data must be resorted to, the calculated results may have to be punched out on cards in a suitable arrangement, as contrasted with the simplest or most compact forms of punch out. Another computer application made was the finding of levels automatically. (M.H.R.)

11682 TID-7547(p.30-5)
Nuclear Development Corp. of America, White Plains, N. Y.
DIFFICULTIES ENCOUNTERED IN EXTRAPOLATING LOW ENERGY NEUTRON CROSS SECTION DATA TO OTHER REGIONS. H. Goldstein and M. Kalos. p.30-5 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 6p.

In practical applications of neutron cross section data it is often necessary to fill in, by calculation, gaps in the cross sections where experimental information is inadequate. The problems encountered in extending low energy data to fill such gaps are discussed. The assumptions made in extending this data are: that the experimental information available is sufficiently accurate and covers a sufficient number of resonances that what is taking place at low energy is known, and that it is known how resonance parameters and other cross section properties vary with energy going out of the measured region. Examples are given for the fission width and strength function of U^{235} and the radiative capture cross section for Fe^{54} and Fe^{56}. (M.H.R.)

11683 TID-7547(p.35-7)
Brookhaven National Lab., Upton, N. Y.
RADIATION WIDTHS IN SLOW NEUTRON RESONANCES. H. H. Landon, V. L. Sailor, and H. Marshak. p.35-7 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 3p.

The difficulties involved in attempting to measure neutron resonance cross sections and to analyze resonance behavior with a precision adequate to detect significant features in the systematics of the radiation width parameter Γ_γ are discussed. The deviations between theoretical and experimental values are emphasized. (M.H.R.)

11684 TID-7547(p.37-9)
Argonne National Lab., Lemont, Ill.
FIRST MEASUREMENTS WITH A NEW FAST CHOPPER. L. M. Bollinger, R. E. Coté, T. J. Kennett, and G. E. Thomas. p.37-9 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 3p.

A new rotor designed for transmission measurements and made of monel metal and uranium is described. The advantages of cigar-shaped slits in this rotor are pointed out. Transmission results are given showing the resonances in Mn^{55} at 7 and 9 kv. (M.H.R.)

11685 TID-7547(p.39-42)
France. Commissariat a l'Energie Atomique, Paris.
MECHANICAL VELOCITY SELECTOR FOR FILTERING HIGHER ORDER REFLECTIONS. P. Hubert, R. Joly, and C.L. Signarbieux. p.39-42 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 4p.

To extend the useful range of a crystal spectrometer below 0.03 ev, a mechanical velocity selector can be used in conjunction with the spectrometer. The selector consists of 4 discs 60-cm in diameter. Each disc is made of two "duralumin" discs, 2 mm thick, riveted together; the slits are obtained by cementing, with araldite, 0.7 mm thick Cd sectors between the Al discs. This equipment may be used to study near zero resonances and cold neutrons. Some results are given for Nd and Ir. (M.H.R.)

11686 TID-7547(p.42-5)
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
RECENT TOTAL CROSS SECTION MEASUREMENTS. R. G. Fluharty. p.42-5 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 4p.

A summary is presented of the total cross section data taken with the Materials Testing Reactor crystal spectrometer and fast chopper during the preceding year. The major experimental factor involved for these two spectrometers is the 0.08 μsec/meter crystal spectrometer resolution and the 0.04 μsec/meter fast chopper resolution. Some results are given for Au, Na, K, Li^7, Sr, Ca, and Pu^{240}. The MTR fast chopper average energy level parameters are summarized. (M.H.R.)

11687 TID-7547(p.45-8)
Brookhaven National Lab., Upton, N. Y.
NUCLEAR RADIUS BY NEUTRON SCATTERING. K. K. Seth, D. J. Hughes, and R. L. Zimmerman. p.45-8 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 4p.

Results based on potential scattering measurements are presented. The method of determining potential scattering values by subtraction of the resonance contribution is described. The question as to whether potential scattering fluctuates within kilovolt intervals of energy is discussed. The various results are considered in relation to the cloudy crystal ball model. (M.H.R.)

11688 TID-7547(p.49-50)
Princeton Univ., N. J.
DISTRIBUTION OF NEUTRON RESONANCE LEVEL SPACING. E. P. Wigner. p.49-50 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 2p.

The problem of determining the probability of a certain spacing of energy levels is discussed. The Wishart distribution is used to show that the probability of two levels coinciding is zero. The probability that two successive levels have a distance X has not been found. (M.H.R.)

11689 TID-7547(p.50-2)
Los Alamos Scientific Lab., N. Mex.
NEUTRON CROSS SECTION FLUCTUATIONS. C. E. Porter. p.50-2 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 3p.

The deviation of a cross section from its average over a certain energy is considered. The dispersion obtained for one particular model of the fine structure is discussed. The dispersions of the total, elastic scattering, and reaction cross sections as a function of transmission coefficient for s-wave neutrons are plotted. (M.H.R.)

11690 TID-7547(p.52-4)
Academy of Sciences, Moscow.
NEUTRON INTERACTION WITH SPHERICAL AND PROLATE NUCLEI. V. V. Vladimirskii, I. L. Ilyina, A. A. Panov, I. A. Radkevich, and V. V. Sokolovskii. p.52-4 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 3p.

Calculations were made for prolate nuclei on the basis of the optical model with a complex potential. The nucleus was assumed to be a prolate spheroid with a sharp edge. The wave equation inside the spheroid was solved in elliptical coordinates ξ, η. The solution was represented by a sum of the following type: $u(\xi,\eta) = \Sigma\alpha_{KL}(\xi-1)^K P_L(\eta)$. The nucleus is small compared with the wave length of a neutron outside the nucleus. The algebraic equation system was solved for different elongations of the nucleus with the aid of a small electronic computer, all the terms with $L > 14$ being ignored. The results for various nuclear elongations are plotted. Calculated strength functions of spherical nuclei for $\epsilon = 0.105$ are compared with the calculations of others for $\epsilon = 0.10$. Strength functions for spherical and elongated nuclei are also plotted against atomic number and compared with experiment. (M.H.R.)

11691 TID-7547(p.54-7)
Columbia Univ., N. Y.
LOW ENERGY NEUTRON SCATTERING FROM SPHEROIDAL NUCLEI. B. Margolis and E. Troubetzkoy. p.54-7 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS,

HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 4p.

Slow neutrons are assumed to scatter from a static square well complex potential of shape $r = R(1 + aP_2)$. The results of this calculation were published previously. The theory involved in this calculation is reviewed and the significance of these results is discussed. $\overline{\Gamma}_n^0/D$ and R'/R are plotted against atomic number for nuclei with eccentricities $\epsilon = 0, +0.075, 0.1$, and 0.15. Values of $\overline{\Gamma}_n^0/D$ vs atomic number as measured by the Brookhaven group and as calculated from a spherical well are compared. (M.H.R.)

11692 TID-7547(p.57-62)

Los Alamos Scientific Lab., N. Mex.

ROTATIONAL OPTICAL MODELS FOR SCATTERING OF NEUTRONS BY DEFORMED NUCLEI. D. Chase, L. Wilets, and A. R. Edmonds. p.57-62 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 6p.

The scattering of neutrons by a rotating, deformed even-even nucleus was investigated using a diffuse-surfaced complex potential. Coupling to other than the rotational motion of the target was included only via the imaginary part of the potential. The neutron spin was omitted. The most essential approximation introduced is the limitation of target rotational states to the first three: J = 0,2,4. A linear fall-off was assumed for the potential well. In the expansion of the axially symmetric potential in spherical harmonics relative to the principal-axis system, only P_0 and P_2 terms were included. Results are plotted. (M.H.R.)

11693 TID-7547(p.62-3)

Atomenergikommissionen, Denmark.

ON THE SCATTERING OF NEUTRONS ON DEFORMED NUCLEI. C. Wandel. p.62-3 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 2p.

Some unpublished work done in 1953-54 at the Institute of Theoretical Physics in Copenhagen is reported. To a Hamiltonian of the type used in the work of Feshbach, Porter, and Weisskopf was added an interaction, coupling the position of the neutron to the oriented nucleus through an anisotropic surface interaction of the type used in the work of Bohr and Mottelson, and adding a term to account for the rotational energy. This makes it possible, without approximations, to solve the Schroedinger equation in such a way as to get the logarithmic derivative in the incoming channel in terms of matrix elements. Examples of the kind of results obtained are given. (M.H.R.)

11694 TID-7547(p.63-8)

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

DIRECT AND DELAYED PROCESSES FOR RADIATIVE NEUTRON CAPTURE. A. M. Lane and J. E. Lynn. p.63-8 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 6p.

The possibility is explored that radiative neutron capture may occur through a "direct" mechanism, in contrast to the "delayed" compound nucleus mechanism. From a purely phenomenological viewpoint, this mechanism can be expected to occur as a consequence of the appreciable mean free path for motion in nuclear matter; the incident nucleon does not form a compound nucleus immediately on entry into the target nucleus, but rather circulates for a time in an orbit. During this time, it may drop to a lower orbit with the emission of a photon to take up the energy balance. The results of this phenomenological argument are derived from a more fundamental starting point (Wigner-Eisenbud theory). Various experimental measurements are discussed which may be expected to distinguish between the two capture mechanisms. Some existing data are interpreted in terms of the two mechanisms. (M.H.R.)

11695 TID-7547(p.68-71)

Atomic Energy of Canada Ltd., Chalk River, Ont.

COMPUTATION OF AVERAGE NEUTRON CAPTURE CROSS SECTIONS. A. G. W. Cameron. p.68-71 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 4p.

Equations for computing average neutron capture cross sections in the intermediate energy range for many different nuclei are discussed. It is pointed out that the critical quantities entering into the average capture cross sections are the nuclear level spacings, nuclear radiation widths, and the neutron strength functions. The first two are functions of the neutron binding energy. A revised semi-empirical atomic mass formula designed to improve computations of neutron binding energies is presented. The basis of the revision is the use of a trapezoidal radial density distribution for the nucleus which approximates its diffuse edge and has a radius and surface thickness fixed to agree with Stanford electron scattering results. Approximate nucleon orbit spacings were computed using the revised semi-empirical atomic mass formula. It is shown that the radiation widths associated with p-wave neutron capture are often quite different from the widths associated with s-wave neutron capture. (M.H.R.)

11696 TID-7547(p.71-7)

Oak Ridge National Lab., Tenn.

PART I. THE EFFECT OF FLUCTUATIONS IN THE WIDTHS ON NEUTRON REACTION CROSS SECTIONS. p.71-3. PART II. AN ANALYSIS OF LOW-ENERGY NEUTRON REACTIONS IN U^{238}. L. Dresner. p.73-7 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 7p.

The cross section for reaction from one channel to another averaged over many levels of the compound nucleus is given. Part of the cross section expression represents an average taken over the distributions of the various partial widths. Recently, it was shown that the neutron resonance levels are distributed in a chi-squared distribution of one degree of freedom and that the radiative widths are essentially constant. Some relatively simple cases of the evaluation of averages over partial width distributions are given. A Monte Carlo code devised for the evaluation of others using the ORACLE is discussed. Strength functions for the various partial waves are deduced from experimental cross sections for U^{238}. Theoretical considerations together with the low-energy resonance data serve to determine everything but the P-wave strength function, which can be determined from reaction data. A P-wave strength function somewhat larger than the S-wave strength function is indicated. The predicted angular distribution at 550 kev is more isotropic than experimentally observed; the cause of this discrepancy is not known. (M.H.R.)

11697 TID-7547(p.77-9)
Brookhaven National Lab., Upton, N. Y.
NEUTRON STRENGTH FUNCTIONS. R. L. Zimmerman and D. J. Hughes. p.77-9 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 3p.

The importance of the strength function is emphasized in terms of its value in testing current theoretical models, and the relative ease with which experimenters can connect it with resonance parameters, reduced neutron width, and level spacing. The methods for obtaining strength function data with the Brookhaven fast chopper are described. Results are given together with some recent theoretical attempts to explain the observations. (M.H.R.)

11698 TID-7547(p.79-81)
Argonne National Lab., Lemont, Ill.
STRENGTH FUNCTION MEASUREMENTS. R. E. Coté, L. M. Bollinger, and J. M. Leblanc. p.79-81 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 3p.

The Argonne fast-neutron velocity selector was used to measure the total cross sections of a number of nuclides whose nucleon numbers lie between 45 and 93, in order to determine their strength functions. Two classes of data are obtained from which the values of the strength function can be calculated. These are discussed and illustrated by the resonance structure of bromine and the slow neutron transmission of scandium. The results of such measurements are compared with the predictions of the "cloudy crystal ball" model. (M.H.R.)

11699 TID-7547(p.81-4)
Argonne National Lab., Lemont, Ill.
ON THE VALIDITY OF THE NUCLEAR SHELL MODEL AT EXCITATION ENERGIES OF 5 TO 10 Mev. N. Rosenzweig. p.81-4 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 4p.

An attempt is made to show that conclusions can be drawn about the validity of the shell model at 5 to 10 Mev by analyzing the level densities of excited nuclei as observed in the resonance scattering of slow neutrons. (M.H.R.)

11700 TID-7547(p.85-91)
Argonne National Lab., Lemont, Ill.
EXPERIMENTAL TESTS OF FISSION AND REACTION THEORY FOR SLOW NEUTRONS. L. M. Bollinger. p.85-91 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 7p.

Experimental results for the neutron cross sections of Pu^{239} and the dependence of fission fragment mass distribution on the incident neutron energy are examined. Data given for Pu^{238} are: total neutron cross sections, fission cross sections, fission widths, radiation widths, and neutrons emitted per neutron absorbed. The findings show that the number of channels available for fission of Pu^{239} by slow neutrons is small, probably one or two. The average fission width seems to be of the same order of magnitude for both spin states. Differences in the mass distribution from resonance to resonance, if present, are difficult to establish. (M.H.R.)

11701 TID-7547(p.92-7)
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
ON THE CORRELATION OF THE NUCLEAR ENERGY LEVELS OF U^{236} AND Pu^{240}. P. A. Egelstaff. p.92-7 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 6p.

Experimental data on the fission and total cross sections of U^{235} and the fission cross section of Pu^{239} were analyzed by group analysis methods. Correlograms and other plots of the data are shown. It is concluded that there is evidence for a correlation effect in the slow neutron cross sections of U^{235} and Pu^{239}. (M.H.R.)

11702 TID-7547(p.98-105)
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
NEUTRON INTERACTIONS WITH U^{233} FOR NEUTRON ENERGIES $< 10^4$ EV. J. E. Evans and R. G. Fluharty. p.98-105 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 8p.

Fission cross section plots are given for U^{233} from 0.001 to 1 ev, 0.03 to 2.5 ev, 0.1 to 11 ev, and 1 to 1000 ev. Total cross sections from 1 to 3000 ev and 100 to 10,000 ev are included. Theoretical fits to the data are attempted. (M.H.R.)

11703 TID-7547(p.105-6)
Oak Ridge National Lab., Tenn.
LOW ENERGY NEUTRON CROSS SECTIONS OF FISSION PRODUCTS. J. A. Harvey, R. C. Block, and G. G. Slaughter. p.105-6 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 2p.

The Oak Ridge fast chopper time-of-flight spectrometer at the Low Intensity Training Reactor was used to make transmission measurements on fission product samples. The total cross sections of fission product samarium and promethium are given. (M.H.R.)

11704 TID-7547(p.107-12)
Brookhaven National Lab., Upton, N. Y.
SLOW NEUTRON RESONANCE ANALYSIS PROBLEMS IN U^{235}. F. J. Shore and V. L. Sailor. p.107-12 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 6p.

Evidence for asymmetry in the fission resonances and the method used to analyze the data are presented. Neutron cross sections for U^{235} are given. It is concluded that the data indicate that interference does occur between levels in the fission, and that it is wiped out in the capture. This is consistent with the idea of the existence of at most a few exit channels for fission and many for capture. (M.H.R.)

11705 TID-7547(p.112-13)
Atomic Energy of Canada Ltd. [Chalk River Project], Chalk River, Ont.
RELATIVE VALUES OF THERMAL NEUTRON FISSION CROSS SECTIONS. C. B. Bigham, G. C. Hanna, M. Lounsbury, and P. R. Tunnicliffe. p.112-13 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 2p. (UK/C/6/124).

Also issued separately as UK/C/6/124 and previously abstracted in NSA, Vol. 12, abstract No. 10944.

11706 TID-7547(p.113-16)
Atomic Energy of Canada, Ltd. [Chalk River Project], Chalk River, Ont.
THE THERMAL FISSION CROSS SECTION OF U^{233}. P. R. Tunnicliffe, C. B. Bigham, P. J. Campion, and G. C. Hanna. p.113-16 [of] THE INTERNATION CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 4p. (UK/C/6/125).

Also issued separately as UK/C/6/125 and previously abstracted in NSA, Vol. 12, abstract No. 10227.

11707 TID-7547(p.117-18)
Argonne National Lab., Lemont, Ill.
THE TOTAL NEUTRON CROSS SECTIONS OF Pu^{240}, Pu^{242} AND Am^{243}. R. E. Coté, L. M. Bollinger, R. F. Barnes, and H. Diamond. p.117-18 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 2p.

The Argonne fast-neutron velocity selector was used to measure the total cross sections of Pu^{242} and Am^{243} and to study several resonances in Pu^{240}. The Pu^{240} results were obtained as a by-product of an extensive study of Pu^{239}. The major part of this series of measurements was that devoted to Pu^{242} and Am^{243}. Total cross sections and resonance parameters are included. (M.H.R.)

11708 TID-7547(p.118-21)
Atomic Energy of Canada Ltd. [Chalk River Project], Chalk River, Ont.
THE RATIO OF THE RESONANCE INTEGRAL TO THE 2200 M/S CROSS SECTION FOR Pu^{240}. W. H. Walker and C. H. Westcott. p.118-21 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 4p. (UK/C/6/119).

Also issued separately as UK/C/6/119 and abstracted in NSA, Vol. 12, abstract No. 4398.

11709 TID-7547(p.121-5)
Babcock and Wilcox Co., New York.
THE EFFECTIVE RESONANCE INTEGRAL OF THORIUM AND THORIUM OXIDE. I. E. Dayton and W. G. Pettus. p.121-5 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 5p.

This experiment was carried out using conventional "danger coefficient" techniques. A Cd tube was mounted inside the Pennsylvania Research Reactor and samples were placed in it for measurement. Absolute calibration was obtained by use of B samples. Measurements were made on four series of samples: (1) Th metal rods, 0.16 to 1.41 in diam., density 11.7 (nine samples); (2) Th metal plates 0.056 to 0.896 in. thick, 1.016 in. wide (six samples); (3) ThO_2 rods 0.29 to 1.40 in. diam., density 7.1 (fired ceramic) (eight samples); and (4) ThO_2 rods, 0.56 to 1.43 in. diam., density 2.6 (powder) (six samples). The results are tabulated. (M.H.R.)

11710 TID-7547(p.125-30)
Los Alamos Scientific Lab., N. Mex.
DISTRIBUTION OF FISSION NEUTRON NUMBERS. J. Terrell. p.125-30 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 6p.

Published in Phys. Rev. 108, 783-9(1957) Nov. 1, and previously abstracted in NSA, Vol. 12, abstract No. 3148.

11711 TID-7547(p.130-5)
Los Alamos Scientific Lab., N. Mex.
INTERPRETATION OF DELAYED NEUTRON PHENOMENA. G. R. Keepin. p.130-5 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 6p.

Systematics of delayed neutron characteristics were observed experimentally for "fast" fission of six nuclides (U^{235}, U^{233}, U^{238}, Pu^{239}, Pu^{240}, and Th^{232}) and for thermal fission of three nuclides (U^{235}, U^{233}, and Pu^{239}). In contrast to the relative constancy of delayed neutron periods, the observed variations in both relative and total yields among the nuclides are large. In order to explain these yield values, an attempt was made to determine the precursors responsible for each delayed neutron group. (M.H.R.)

11712 TID-7547(p.135-8)
Oak Ridge National Lab., Tenn.
FISSION FRAGMENT STUDIES WITH A MAGNETIC SPECTROGRAPH. B. L. Cohen and C. B. Fulmer. p.135-8 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 4p.

A brief summary of work done with a fission fragment magnetic spectrograph in the Oak Ridge graphite reactor from November, 1955 to May, 1957, is given. Observed H_ρ distributions for mass 91, 97, and 131 are plotted. (M.H.R.)

11713 TID-7547(p.139-40)
France. Commissariat a l'Energie Atomique, Paris.
STUDY OF THE VARIATION OF TERNARY FISSION VERSUS THE ENERGY OF INCIDENT NEUTRONS. J. M. Auclair. p.139-40 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 2p.

The relative probability of ternary fission induced in U^{235} and Pu^{239} by slow neutron emission of long-range α particles has been measured by several physicists. Work done at Saclay to investigate discrepancies in these measurements and to determine if the probability of the process varies with incident neutron energy is reported. The experimental arrangement is sketched. Preliminary measurements permitted no conclusion. (M.H.R.)

11714 TID-7547(p.140-2)
France. Commissariat a l'Energie Atomique, Paris.
MEASUREMENT OF THE NUMBER OF NEUTRONS EMITTED PER FISSION INDUCED IN U^{238} BY 14.2 Mev NEUTRONS. G. Vendryes, S. Blaize, M. Gaudin, R. Joly, and J. Leroy. p.140-2 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 3p.

The experimental arrangement shown involves essentially a fission chamber loaded with natural U and surrounded with a set of BF_3 counters enclosed in paraffin. The experiment was repeated using depleted U. After corrections, the final value for the mean number of neutrons produced was found to be: $4.45^{+0.10}_{-0.20}$. (M.H.R.)

11715 TID-7547(p.142-6)
Los Alamos Scientific Lab., N. Mex.
FISSION INDUCED BY (d,p) STRIPPING REACTIONS. J. A. Northrop, R. H. Stokes and K. Boyer. p.142-6 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT

COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 5p.

The (d,p) fission process in U^{238} and U^{235} was studied at a cyclotron deuteron energy of 14 ± 0.2 Mev. The (d,p-f) threshold measurements were made observing protons at 90°. From the results it is concluded that of all fissions that occur in deuteron bombardment of U, practically none came from the (d,p) process. Another conclusion is that only a small fraction of compound nuclei formed by the (d,p) reaction decay by fission. (M.H.R.)

11716 TID-7547(p.146-52)
Princeton Univ., N. J.
REGULARITIES AND ANOMALIES IN THE COMPETITION BETWEEN NEUTRON EMISSION AND FISSION. John A. Wheeler. p.146-52 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 7p.

The subject is discussed in two sections: (1) the channel analysis of fission and (2) the physics of scission, including the asymmetry of the mass distribution of fragments and the excitation of the fission fragments. The stability of very heavy nuclei beyond element 102 is mentioned briefly. (M.H.R.)

11717 TID-7547(p.153-9)
Duke Univ., Durham, N. C.
NEUTRON RESONANCE PARAMETERS AS FUNCTIONS OF ANGULAR MOMENTUM. H. W. Newson. p.153-9 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 7p.

A sketch of the 122° spectrometer used for total cross section measurements is given. Some results with a 160° spectrometer are given. Work on total, capture, and elastic scattering cross sections done at Duke during the last 4 years is reported. Cross sections for Ni^{58}, Ni^{60}, F, U^{238}, Pt^{198}, Mg, Y, Mo, Ba, and Sr are presented. A schematic diagram of apparatus used for measuring 90 and 180° differential cross sections and a floor plan showing over-all arrangement of apparatus are included. (M.H.R.)

11718 TID-7547(p.159-62)
Duke Univ., Durham, N. C.
A NEW SPECTROMETER FOR TOTAL CROSS SECTION MEASUREMENTS IN THE KEV REGION. E. G. Bilpuch, P. F. Nichols, and H. W. Newson. p.159-62 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 4p.

A cross sectional view of the new 160° spectrometer and an enlargement of the target chamber are shown. Protons from the Van de Graaff are sent through a magnetic analyzer and an electrostatic analyzer. They then go through the center of the spectrometer, through a circular aperture, and into the target chamber. A high vacuum is maintained in the target chamber by a liquid air, charcoal trap. The spectrometer is essentially made up of three coaxial, truncated, polyethylene cones. Neutrons are detected by BF_3 counters in the polyethylene counter matrix. Total cross section data from the old 122° spectrometer and the new 160° spectrometer are compared for natural iron and barium to show the resolution of the new one. Plots of resolution and scattered background as a function of neutron energy for the 160° spectrograph are given. (M.H.R.)

11719 TID-7547(p.162-6)
Oak Ridge National Lab., Tenn.
NEUTRON TOTAL CROSS SECTION IN THE KILOVOLT REGION. W. M. Good, J. H. Gibbons, and J. H. Neiler. p.162-6 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 5p.

The ORNL method of measuring cross sections, which is actually a cross between the Van de Graaff and the time-of-flight methods, is outlined briefly. The 3 million volt Van de Graaff accelerator with a pulsed ion source is used. The detector is a slab of B^{10} viewed by a NaI crystal, which detects the γ-rays from the $B^{10}(n,\alpha\gamma)Li^7$ reaction. Total cross sections of Se measured by this time-of-flight method and the ordinary Van de Graaff techniques are compared. Total cross sections of K^{41}, Rb^{87}, Y^{89}, Na^{23}, Ti, and Bi^{209} are given. Some other kilovolt neutron cross section measurements are tabulated. (M.H.R.)

11720 TID-7547(p.167-70)
Argonne National Lab., Lemont, Ill.
NEUTRON TOTAL CROSS SECTIONS IN THE KEV REGION: Al, Cr, AND Fe. C. T. Hibdon. p.167-70 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 4p.

Neutron total cross sections were measured by the transmission method using neutrons produced by the $Li^7(p,n)$ reaction with protons generated by the Argonne Van de Graaff. A schematic diagram of the counting equipment and its position relative to the proton beam is given. The results for aluminum are presented and discussed in detail. Separate plots of the neutron total cross sections for Al are given for the following ranges: 20 to 80 kev, 80 to 266 kev, and 266 to 415 kev. Analyses of the following resonances for Al are included: 35.3 kev, 120 kev, and a cluster at 370 kev. (M.H.R.)

11721 TID-7547(p.170-3)
California. Univ., Livermore. Radiation Lab.
TOTAL CROSS SECTIONS IN THE 7 TO 14 MEV RANGE. J. M. Peterson, A. Bratenahl, and J. P. Stoering. p.170-3 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 4p.

The neutron source was the d-d reaction. The deuteron beam supplied by the Livermore variable cyclotron struck a deuterium gas target. The geometry of the arrangement is shown. A typical pulse height spectrum in the plastic scintillator and a time spectrum of the beam striking the detector, for the nominal 14-Mev case, are presented. The measured cross sections for 34 isotopes are plotted. It is pointed out that the optical model fits the data. (M.H.R.)

11722 TID-7547(p.173-7)
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE EXCITATION AND STUDY OF DISCRETE NUCLEAR LEVELS BY INELASTIC NEUTRON SCATTERING. Joan M. Freeman. p.173-7 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 5p.

Neutron scattering was studied by observing the gamma rays subsequently emitted from the residual excited nucleus with a NaI(Tl) crystal. Neutrons were produced by bombarding a ZrT target with protons from an electrostatic generator. The material under investigation was in the form of a ring scatterer accepting neutrons at a mean angle of 7° to the forward direction.

Results for Na using this method are given. The ring geometry method requires an appreciable amount of target material. A method used at Los Alamos is presented which requires a scattering sample of only 5 g of Na as contrasted with 400 g for the ring method. Some of these results for Zr^{94} and preliminary decay schemes for isotopes Zr^{90}, Zr^{92}, and Zr^{94} are included. (M.H.R.)

11723 TID-7547(p.178-81)
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
NEUTRON SPECTROSCOPY WITH A HELIUM-3 SPECTROMETER. A. T. G. Ferguson and G. C. Morrison. p.178-81 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 4p.

The He^3 neutron spectrometer developed at Harwell is a proportional counter containing He^3. The earlier applications of this spectrometer are mentioned briefly. The work on the p + d reaction is discussed in more detail. A target of zirconium deuteride was bombarded with protons from the Harwell Electrostatic Generator and the neutron spectrum at 0° to the beam was observed for three proton energies near the threshold, 3.52, 3.72, and 3.92 Mev. The $V^{51}(p,n)Cr^{51}$ reaction was studied by bombarding V targets with protons of energies between 2.3 and 4.0 Mev and determining the spectra of neutrons emitted at 0°. An attempt was made to analyze these results in terms of the Hauser-Feshbach theory. (M.H.R.)

11724 TID-7547(p.181-3)
France. Commissariat a l'Energie Atomique, Paris.
ANGULAR DISTRIBUTIONS OF INELASTIC NEUTRONS AT LOW ENERGIES. V. Naggiar, G. C. Phillips, M. Roclawskiconjeaud, and D. Szteinsznaider. p.181-3 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 3p.

The experiments reported were intended to investigate whether the inelastic scattering of neutrons at low energies by the nucleus could proceed to some extent by direct interaction instead of only through an intermediate compound nucleus state. A possible asymmetry in the number of inelastic neutrons in the forward and backward direction was sought. Neutrons from the proton-tritium reaction were used. The technique was applied to the inelastic scattering of neutrons by Fe^{56} exciting the first level of 850 kev and to the first level of 60 kev for I^{127}. The asymmetry 30°/150° for I^{127} is 1.05 ± 0.05. (M.H.R.)

11725 TID-7547(p.184-9)
Wisconsin. Univ., Madison.
EXPERIMENTS WITH POLARIZED NEUTRONS AND THE OPTICAL MODEL OF THE NUCLEUS. H. H. Barschall. p.184-9 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 6p.

The typical behavior of the neutron cross section of a heavy nucleus is contrasted with the behavior predicted by the compound nucleus theory. Difficulties involved in attempting to introduce spin orbit coupling into the optical potential are discussed. Attempts to measure the spin orbit effects directly by observing the polarization of the scattered neutrons are described. The Li(p,n) reaction is used as a source of monoenergic neutrons. The total neutron cross section of oxygen and neutron scattering phase shifts of O^{16} are shown. The angular dependence of polarization in scattering from Mo, Ag, Ta, Zr, and U is plotted. The data clearly show the importance of spin-orbit coupling in the interaction of neutrons with intermediate and heavy nuclei in the energy range below 1 Mev. It is concluded that the optical model has not yet been perfected to fit the polarization data. (M.H.R.)

11726 TID-7547(p.190-1)
Wisconsin. Univ., Madison.
STRENGTH FUNCTION DETERMINATIONS USING FAST NEUTRONS. S. E. Darden and F. Boreli. p.190-1 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 2p.

Strength function determinations were made on a number of intermediate and heavy nuclei by observing the extent to which the transmission of a neutron beam through a scattering sample deviates from an exponential dependence on sample thickness. Li(p,n) neutrons were used. Preliminary results of s-wave measurements on a number of elements are shown. In order to compare these data with the predictions of the optical model, the values obtained from the lower energy measurements were plotted vs. atomic weight. The data were analyzed to yield p-wave strength functions for Se, Zr, and Nb. (M.H.R.)

11727 TID-7547(p.191-5)
Akademia Nauk S.S.S.R. Institut [Fiziki im] P. N. Lebedeva.
$He^3(n,p)$ CROSS SECTION FOR NEUTRON ENERGIES UP TO 25 KEV AND EXCITED LEVEL IN He^4. A. A. Bergman, A. I. Isakov, Yu. P. Popov, and F. L. Shapiro. p.191-5 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 5p.

Also issued separately as SCL-T-151 and previously abstracted in NSA, Vol. 12, abstract No. 4493.

11728 TID-7547(p.195-8)
Rice Inst., Houston, Texas.
RADIATIVE CAPTURE OF FAST NEUTRONS IN F^{19}. T. W. Bonner, F. Gabbard, and R. H. Davis. p.195-8 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 4p.

The neutron sources were $Li^7(p,n)$ between 0.010 and 0.600 Mev, and $T(p,n)He^3$ for energies above 0.600 Mev. The $F^{19}(n,\gamma)F^{20}$ excitation curve is shown and resonances are tabulated. A composite total cross section curve is presented. Energy levels of F^{20} obtained from radiative capture measurements are sketched. Observed radiative level widths in F^{20} are compared with Weisskopf single particle estimates. Since more (n,γ) resonances were found than appear in total cross section measurements, a need for better measurements in this range is indicated. (M.H.R.)

11729 TID-7547(p.198-202)
Bartol Research Foundation, Philadelphia.
ELASTIC SCATTERING OF 3.7 MEV NEUTRONS BY SULPHUR, IRON AND COBALT. S. C. Snowden. p.198-202 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 5p.

The differential cross sections for S, Fe, Co, Ni, Cu, Zn, Zr, and Mo were measured using neutrons from d-d

reactions. Angular distributions for all these elements are presented. Legendre coefficients of the angular distributions are tabulated. (M.H.R.)

11730 TID-7547(p.202-5)
Oak Ridge National Lab., Tenn.
DIFFERENTIAL ELASTIC SCATTERING OF NEUTRONS FROM LIGHT NUCLEI. J. L. Fowler and H. O. Cohn. p.202-5 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 4p.

The cases are discussed in which the target nuclei have zero spin: O^{16}, C^{12}, and Ne^{20}. Different cross sections of oxygen at 1 and 1.8 Mev and phase shifts of the various levels are plotted. Differential cross sections of neon from 1.2 to 1.45 Mev and from 1.57 to 1.75 Mev are presented along with the experimental arrangement for the scattering experiment. (M.H.R.)

11731 TID-7547(p.205-7)
Groningen, Netherlands. Rijksuniversiteit. Natuurkundig Laboratorium.
SCATTERING OF FAST NEUTRONS BY THE NEON ISOTOPES Ne^{20} AND Ne^{22} IN THE ENERGY RANGE 1.9 TO 3.5 MEV. C. P. Sikkema, P. J. Pasma, and H. H. Van Barneveld. p.205-7 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 3p.

Total cross sections and differential elastic scattering cross sections for Ne^{20} and Ne^{22} were determined by measuring recoils in a neon-filled proportional counter. To reduce the background, an anticoincidence technique was applied between the counter volume and the space surrounding it. The results of measurements with the counter containing an isotopic mixture of 98% Ne^{22} and about 2% Ne^{20}, which had been enriched by the thermal diffusion method, are given. The measured total cross section curve of Ne^{22} reveals 10 resonance peaks at neutron energies of 2.01, 2.14, 2.19, 2.32, 2.53, 2.72, 2.87, 3.10, 3.20 and 3.43 Mev. (M.H.R.)

11732 TID-7547(p.207-9)
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE ENERGY AND ANGULAR DISTRIBUTION OF PROTONS FROM 14 Mev NEUTRON REACTIONS WITH COPPER. D. L. Allan. p.207-9 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 3p.

Published in Nuclear Phys. 6, 464-76(1958) Apr. (1) and previously abstracted in NSA, Vol. 12, abstract No. 9473.

11733 TID-7547(p.210-13)
Centro Informazione Studi Esperienze, Milan; Milan. Universita. Istituto di Fisica; and Italy. Istituto Nazionale di Fisica Nucleare, Sezione de Milano.
FURTHER MEASUREMENTS ON (n,p) REACTIONS AT 14 Mev ON TITANIUM, RHENIUM, SILVER, TIN, TANTALUM, GOLD AND ANGULAR DISTRIBUTIONS OF PROTONS EMITTED IN THE Ca(n,p) AND Ni(n,p) REACTIONS. L. Colli, U. Facchini, G. Marcazzan, A. Sona, and M. Pignanelli. p.210-13 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 4p.

Published in Nuovo cimento (10) 7, 400-10(1958) Feb. 1, and previously abstracted in NSA, Vol. 12, abstract No. 8148.

11734 TID-7547(p.213-17)
Virginia. Univ., Charlottesville.
ANGULAR DISTRIBUTIONS OF ELASTICALLY SCATTERED 14.7 Mev NEUTRONS. S. Berko, W. D. Whitehead, and B. C. Groseclose. p.213-17 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 5p.

Published in Nuclear Phys. 6, 210-18(1958) Mar. and previously abstracted in NSA, Vol. 12, abstract No. 8144.

11735 TID-7547(p.218-25)
Division of Research, AEC.
INELASTIC NEUTRON SCATTERING IN FISSIONABLE NUCLIDES. T. H. Johnson. p.218-25 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 8p.

The pulsed beam time-of-flight method was used for studying the spectra of secondary neutrons produced from the scattering of monoenergetic neutrons in U^{238}. The primary neutron energies used were 550 kv, 1 Mv, and 2 Mv. Angular distributions for inelastic scattering and time spectra of neutrons from neutron interactions are given. Preliminary scattering data for U^{235} and Pu^{239} are also given. (M.H.R.)

11736 TID-7547(p.225-30)
Los Alamos Scientific Lab., N. Mex.
THE MEASUREMENT OF $\sigma_{n,\gamma}$ (E)/σ_{nf} (E) OF U^{235} FOR FAST NEUTRONS. B. C. Diven. p.225-30 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 6p.

A recent measurement of α, the ratio of the radiative capture to fission cross section of U^{235}, is described. This was done for monoenergetic neutrons over the energy range from 175 kev to 1 Mev by measuring the capture gamma radiation with a liquid scintillator. Capture and fission are distinguished by the neutrons which follow fission. The addition of some Cd salt into the scintillator solution ensures that the fission neutrons will be captured by Cd and the resulting 9 Mev of gamma radiation is ample to provide a pulse to identify a neutron. (M.H.R.)

11737 TID-7547(p.230-2)
Brookhaven National Lab., Upton, N. Y.
FAST NEUTRON STUDIES BY TIME-OF-FLIGHT. G. N. Glasoe, H. H. Landon, A. J. Elwyn, and Sophie Oleksa. p.230-2 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 3p.

The method is described, using the BNL 18-in. cyclotron, for exploiting beam-bunching to produce high-intensity short pulses of neutrons for inelastic scattering studies. Protons accelerated to 3 Mev are deflected and focused on a Zr–T target. A plastic scintillator and photomultiplier used in conjunction with fast electronic circuits provide adequate detection efficiency to study neutrons with energies down to a few hundred kev. The time spectrum is transformed to a pulse height spectrum by means of a special "r-f vernier" time-to-pulse-height converter. A typical plot of data without counting rate loss corrections is shown, as they were recorded on the multichannel analyzer for neutron scattering from Fe at 90° with primary neutron energy of 2.2 Mev. Data at 45 and 145° are plotted. Angular distributions for elastic and inelastic scattering are shown. (M.H.R.)

11738 TID-7547(p.232-5)
California. Univ., Livermore. Radiation Lab.
ELASTIC AND INELASTIC SCATTERING OF 14 MEV NEUTRONS BY TIME-OF-FLIGHT. M. P. Nakada. p.232-5 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 4p.

An experiment dealing with the angular distribution of the low energy neutrons emitted when 14-Mev neutrons are inelastically scattered by medium and heavy nuclei is discussed. Forward peaking is observed in the results and possible causes of this are discussed. (M.H.R.)

11739 TID-7547(p.236-40)
Akademia Nauk S.S.S.R.
INVESTIGATIONS OF REACTIONS OF 18 MEV DEUTERONS WITH LIGHT NUCLEI BY THE TIME OF FLIGHT METHOD. N. A. Vlasov, G. F. Bogdanov, S. P. Kalinin, B. V. Rybakov, and V. A. Sidorov. p.236-40 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 5p.

The states of certain light nuclei produced in the reactions (d,n) and (d,p) were studied. An attempt was made to check the existence of the α-particle excited state, discovered in the reaction T(p,n), and to find Li^4 and H^4 in the reactions T(d,p) and He^3(d,n). A study of the neutron spectrum of the reaction T + d and its comparison with the neutron spectrum of He^3 + d affirms the existence of an excited state of 22 Mev in He^4, and points to the absence of such a state in Li^4. It follows that the excited state of He^4 corresponds to the isotopic spin T = 0. The reactions (d,pn), d + d, and He^4 + d were also studied. (M.H.R.)

11740 TID-7547(p.240-4)
Akademia Nauk S.S.S.R.
NEUTRON SPECTRA OF REACTIONS MEASURED USING A 1.5 METER CYCLOTRON AND THE TIME OF FLIGHT METHOD. G. F. Bogdanov, N. A. Vlasov, S. P. Kalinin, B. V. Rybakov, and V. A. Sidorov. p.240-4 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 5p.

The chief elements of the spectrometer are diagramed. The (p,n) reactions in T, Li^6, and Li^7 were studied. Curves of angular distributions, neutron spectra, and time-of-flight distributions for these reactions are given. (M.H.R.)

11741 TID-7547(p.244-6)
California. Univ., Livermore. Radiation Lab.
MEASUREMENT OF 14 Mev n, 2n CROSS SECTIONS. V. J. Ashby, H. C. Catron, L. L. Newkirk, and C. J. Taylor. p.244-6 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 3p.

Large liquid scintillators with a high efficiency for the detection of neutrons are suggested for measuring (n,2n) cross sections. Experimental values for the 14-Mev (n,2n) cross sections are given for D, Be, C, N, F, Fe, Cu, Ag, Ta, Au, Pb, and Bi and compared with other experimental and theoretical values. (M.H.R.)

11742 TID-7547(p.246-8)
Argonne National Lab., Lemont, Ill.
DIFFERENTIAL ELASTIC SCATTERING OF 14 MEV NEUTRONS. L. A. Rayburn. p.246-8 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 3p.

The associated-particle technique using the H^3(d,n)He^4 reaction is described. The circuitry is diagramed and discussed. Angular distributions for elastic neutron scattering of Sb, Sn and Zn are given. The electric scattering of 14 Mev neutrons on Bi at $\theta = 20.2°$ is plotted. (M.H.R.)

11743 TID-7547(p.248-51)
Glasgow Univ.
PROTONS EMITTED FROM Fe^{54} AND Fe^{56} ON BOMBARDMENT WITH 13.5 Mev NEUTRONS. P. V. March and W. T. Morton. p.248-51 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 4p.

Published in Phil. Mag. (8) 3, 143-51(1958) Feb. and previously abstracted in NSA, Vol. 12, abstract No. 8112.

11744 TID-7547(p.252-61)
Atomic Energy of Canada Ltd., Chalk River, Ont.
STUDIES OF THE (n,γ) REACTION. G. A. Bartholomew, P. J. Campion, J. W. Knowles, and G. Manning. p.252-61 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 10p.

A survey of earlier work on neutron capture γ-ray spectra is presented, in which some of the more important experimental results and the conclusions that may be derived from them are pointed out. Some of the more recent neutron capture γ-ray measurements carried out at the Chalk River Laboratories are described. Data are presented for V, Ag, Cd^{114}, Fe, Mg, B, Ti, and Ta. (M.H.R.)

11745 TID-7547(p.261-3)
Akademia Nauk S.S.S.R.
SPECTRA OF GAMMA-RAYS FROM RADIATIVE CAPTURE OF THERMAL NEUTRONS FOR EVEN-EVEN RADIATING NUCLEI WITH ROTATIONAL LEVELS. L. V. Groshev, A. M. Demidov, V. N. Lutsenko, and V. I. Pelekhov. p.261-3 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 3p.

Gamma ray spectra produced in the capture of thermal neutrons were measured by means of a magnetic Compton spectrometer. These spectra are given for Gd, Hf, Dy^{165}, Ta^{182}, and W^{182}. (M.H.R.)

11746 TID-7547(p.263-5)
Akademia Nauk S.S.S.R.
PECULIARITIES OF GAMMA TRANSITIONS IN LIGHT ODD-ODD NUCLEI FORMED IN THERMAL NEUTRON CAPTURE. L. V. Groshev, and A. M. Demidov. p.263-5 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 3p.

Working with natural isotopic mixtures, gamma spectra of even-odd and odd-odd nuclei were studied in the range $20 \leq A \leq 60$. For light nuclei, the gamma spectra produced by neutron capture is combined with data by other authors on level energies to compile decay schemes for gamma transitions. This work deals only with the disintegration of the initial state produced in thermal neutron capture. Even-odd and odd-odd

nuclei with an equal number of neutrons are compared: $Si^{29}-Al^{28}$, $Ca^{41}-K^{40}$, and $Fe^{57}-Mn^{56}$. (M.H.R.)

11747 TID-7547(p.266-73)
Yale Univ., New Haven.
GAMMA RAYS FOLLOWING RESONANT NEUTRON CAPTURE. H. L. Schultz, C. K. Bockelman, J. Draper, C. A. Fenstermacher, and L. Rosler. p.266-73 of THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 8p.

Gamma radiation following slow neutron capture in isolated resonances, where the spin of the compound state is uniquely defined, is investigated. The Yale linear electron accelerator with a Be target was used as the source of photoneutrons. A NaI(Tl) scintillation spectrometer was used. Data on the following are presented and discussed: B^{10}, Sm, Sm^{150}, Er, Hf^{178}, In^{116}, and U. (M.H.R.)

11748 TID-7547(p.274-6)
Joint Establishment for Nuclear Energy Research, Kjeller, Norway.
CIRCULAR POLARIZATION OF GAMMA RAYS RESULTING FROM THE CAPTURE OF POLARIZED NEUTRONS. G. Trumpy. p.274-6 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 3p.

No sensitive method exists for the measurement of circular polarization of radiation. The dependence of the Compton cross section upon the relative orientation of the gamma ray and the scattering electron was applied. An analyzing magnet constructed so that the gamma rays have to pass through 8 cm of iron magnetized parallel or antiparallel to the direction of propagation was used. The sensitivity is very small. Decay schemes of nuclei studied to determine the ground state spins are given for Fe^{57}, Ni^{59}, Zn^{65}, and W^{183}. Examples of neutron capture gamma rays which result in excited states are shown for S^{33}, Ca^{41}, and Ti^{49}. In the cases of Cr^{54} and Cu^{64} the capturing states can have two different spins, $J_c = J_i \pm \frac{1}{2}$. (M.H.R.)

11749 TID-7547(p.277-9)
Massachusetts Inst. of Tech., Cambridge.
PHOTONEUTRON SPECTRA. C. P. Sargent and W. Bertozzi. p.277-9 [of] THE INTERNATIONAL CONFERENCE ON THE NEUTRON INTERACTIONS WITH THE NUCLEUS, HELD AT COLUMBIA UNIVERSITY, SEPTEMBER 9-13, 1957. 3p.

A bremsstrahlung spectrum of x rays was used to excite the nuclei. The electron beam from the linear accelerator via a magnetic analyzer passes through a bremsstrahlung target and is stopped in a carbon block. Photoneutron spectra for Pb, Bi, Au, and Ta are presented and discussed. (M.H.R.)

11750
PRESENT STATUS OF NEUTRON SOURCE CALIBRATIONS. Karl-Erik Larsson (AB Atomenergi, Stockholm). J. Nuclear Energy 6, 322-30(1958) May.

During the last three years, six different Ra–Be neutron sources have been compared directly to the Swedish standard Ra–α–Be source, these six sources coming from U.S.A., U.S.S.R., U.K., Switzerland, and Belgium. On the basis of this series of direct intercomparisons, a "world" average is defined and it is shown that all the absolute measurements fall within ± 2.4 per cent of this average. A survey is given of the absolute measurements included in this direct intercomparison series. (auth)

11751
YVON'S METHOD FOR SLABS. S. Ziering and D. Schiff (Raytheon Manufacturing Co., Waltham, Mass.). Nuclear Sci. and Eng. 3, 635-47(1958) June.

The method of half-range polynomials is applied to neutron transport theory. The specific applicability of this method to problems having discontinuities in the nuclear parameters at the boundaries or interfaces is discussed. Half-range polynomial expansions are used to obtain solutions for both finite and semi-infinite slabs, which consist of isotropically scattering media. The results indicate that the half-range approximations compare favorably with higher approximations obtained from the full-range spherical harmonic or several discrete ordinate methods. In particular, the poor convergence, found in the full-range methods in regions close to the discontinuity, is not present in the half-range method. The latter method is used to obtain a pair of second-order coupled differential equations, as in diffusion theory. (auth)

11752
INVESTIGATION OF THE DIFFUSION OF THERMAL NEUTRONS IN WATER AND PARAFFIN WITH A PULSATING SOURCE. Wolf-Heiner Dio (Univ. of Frankfurt am Main). Nukleonik 1, 13-18(1958) Apr. (In German)

The diffusion and absorption of thermal neutrons in water and paraffin were investigated by the method of the pulsating source. Moderators of different sizes were irradiated with short impulses of fast neutrons and the periodic course of the thermal neutrons from these moderators were measured. The values of the diffusion parameter of thermal neutrons for water and paraffin were therefore measured and compared with the values obtained by others. In water the measurements were made at different temperatures and the temperature dependence of the diffusion coefficient and the diffusion length was determined. (tr-auth)

11753
MEASUREMENTS OF THE POLARIZATION OF (D + T) NEUTRONS AT DEUTERON ENERGY OF 1800 kev. I. I. Levintov, A. V. Miller, and V. N. Shamshev (Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 1030-2(1958) Apr. (In Russian)

Polarization of (d + T) neutrons was measured in a proportional counter with the helium pressure at 18 to 12.5 atm., the angle of oscillation of 22°, and discriminator cut off at 80% of the impulses in head on collisions $n \rightarrow He^4$. The anisotropy of the angular distribution in $d(T,n)He^4$ reaction at E_d = 1800 kev is less than 30% and was not considered in the calculation. The apparatus efficiency was equal to 0.8 to 0.9. A considerable polarization was observed with E_d = 1800 kev. With the increase of deuteron energy the polarization should also increase. (R.V.J.)

Nuclear Physics

11754 AECU-3515
Purdue Research Foundation, Lafayette, Ind.
RESEARCH IN NUCLEAR PHYSICS. Progress Report No. 7. June 15, 1957. 48p. Contract AT(11-1)-122. $1.80(OTS).

A twenty-inch analyzing magnet has been completed except for the final trimming of the pole pieces. In order to further examine the systematics in the angular distribution of elastically scattered alpha particles, the scattering of alpha particles from spectroscopically pure O^{16} and hydrogen sulfide gases was studied. The

change of the static quadrupole interaction in indium metal with temperature was investigated. Results give a value $Q = 10^{-24}$ cm^2. An experimental study of the beta-gamma directional correlations in the decay of Au^{198}, I^{128}, Ce^{144}, and K^{42} has been undertaken. The long-range as well as the short-range stability of the fast coincidence scintillation spectrometer has been improved by building new 404A limiter circuits. The directional correlation of the 172 to 247 kev gamma cascade of Cd^{111} was measured for gaseous $InCl_3$ sources as a function of the delay introduced into the channel accepting the first gamma ray of the cascade, and also as a function of the source temperature and pressure. This was done in an attempt to determine the nature of the interaction to which the Cd^{111} nucleus is subjected when the source is in the gaseous state. In the decay of Cl^{40} there is evidence for gamma rays of 0.55, 0.66, 0.96, 1.1, 4.2, and 6.3 Mev. A half life of 1.42 ± 0.02 min was determined. Isomerism of In^{110} and In^{112} is being investigated. (For preceding period see COO-173.) (W.D.M.)

11755 AERE-T/R-2492

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE WEISSKOPF UNITS. D. H. Wilkinson. Mar. 1958. 4p. $0.21(BIS).

The numerical values of the Weisskopf units are given. A nomogram giving these units as radiative widths or mean life-times for 10 types of radiation and for gamma-ray energies from 2 kev to 20 Mev is included. (M.H.R.)

11756 AFOSR-TN-58-407

Rutgers Univ., New Brunswick, N. J.

DIFFUSION AND NUCLEAR SPIN RELAXATION IN WATER. J. H. Simpson and H. Y. Carr. May 6, 1958. 9p. Contract AF18(603)-6. (AD-158211).

The diffusion coefficient and the spin lattice relaxation time of protons in ordinary water were measured in the temperature range 0 to 100°C using nuclear magnetic resonance free precession techniques. Unlike previous diffusion measurements, the present values describe the diffusion of protons rather than foreign isotopes introduced as tracers. To within the experimental error the Stokes-Einstein relation adequately describes the relative temperature dependence of viscosity and diffusion, but above the vicinity of 40°C the spin lattice relaxation does not follow the viscosity in the predicted manner. (auth)

11757 NP-tr-103

THE PROPER MESON FIELD OF A PHYSICAL NUCLEON. Hing Hu. Translated from a publication of the Joint Institute for Nuclear Research, U.S.S.R. 1957. 29p.

The distribution of mesons in the proper field of a nucleon is calculated based on a model of physical nucleon consisting of a finite core surrounded by a cloud of π mesons. An asymptotic solution which holds when the number of mesons is large is obtained. This solution is expected to account for the region very near to the core. From the theoretical estimation of Friedman, Lee, and Christian and also from the evidence that the orientation of the core in the isotopic spin space and the ordinary spin space may be quite random, it follows that the renormalization factor for the interaction constant may be quite large. If the value obtained by Friedman et al. is accepted and the conventional cut-off value K = 6 is used, then the number of mesons at small distances from the core will be of the order ten. This result is consistent with the view that the production of meson shower by high-energy nucleon-nucleon collisions is due to the shaking off of meson clouds during collision. No inconsistency with the low-energy experiments is introduced by the present theory. (auth)

11758

INTEGRODIFFERENTIAL SYSTEM OF THE COLLISION PROBLEM COMPRISING FOUR NUCLEONS. CASE OF THE STATE WITH TOTAL SPIN 2. Philip Burke and William Laskar. Compt. rend. 246, 3044-7 (1958) May 28. (In French)

The collision of two groups of particles (12, 34) or (1, 324) or (2, 413) was studied by supposing, in addition to a repulsive Coulomb interaction between the particles 2 and 4, the same central interaction between each pair of particles. (The particles are marked as 1, 2, 3, and 4 and those marked as (1, 3) have the same characteristics as (2, 4)). The proper function represents the structure in resonance groups of the system considered. The results are relative to S = 2. (tr-auth)

11759

INTEGRODIFFERENTIAL SYSTEM OF THE COLLISION PROBLEM COMPRISING FOUR NUCLEONS. CASE OF THE STATES OF TOTAL SPIN 0 AND 1. Philip Burke and William Laskar. Compt. rend. 246, 3158-61(1958) June 2. (In French)

The collision of two groups of particles (12, 34) or (1, 324) or (2, 413) was studied by supposing, in addition to the repulsive Coulomb interaction between the particles 2 and 4, the same central interaction between each pair of particles. The proper function represents the structure in resonance groups of the system considered. The results are relative to S = 0 and S = 1. (tr-auth)

11760

ON THE STRUCTURE OF PROTONS. B. B. Dotsenko (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Doklady Akad. Nauk S.S.S.R. 119, 466-8(1958) Mar. 21. (In Russian)

Theoretical studies on proton structure based strictly on the field theory posed many difficulties. In this paper the problem was studied on the basis of some phenomenological approximations. (R.V.J.)

11761

LECTURES ON NUCLEAR THEORY. C. Landau and Ya. Smorodinsky. New York, Consultants Bureau, Inc., 1958. 81p. $15.00.

Lectures are presented on: nuclear forces, scattering of nucleons by nucleons, scattering of nucleons at high energies, nuclear structure (independent particle model), the structure of light nuclei, the structure of heavy nuclei, nuclear reactions (statistical theory), nuclear reactions (optical model, deuteron reactions), π mesons, and the interaction of π mesons with nucleons. (M. H. R.)

11762

ANGULAR CORRELATION BETWEEN RECOIL NUCLEUS AND GAMMA QUANTUM IN ELECTRON CAPTURE. J. Zimanyi (Central Research Inst. of Physics, Budapest). Nuclear Phys. 6, 625-7(1958) May.

The $\nu-\gamma$ angular correlation is obtained for allowed K capture. For a Fermi transition there is no correlation. For a Gamow-Teller transition the correlation is given, and it is found to be the same for T and A coupling, depending only on the polarization of the neutron. (auth)

11763

THE NON-CONSERVATION OF PARITY IN β-DECAY. Bronislaw Kuchowicz (Inst. of Nuclear Research, Polish Academy of Sciences, Warsaw). Nukleonika 3, 184-99(1958). (In Polish)

Data are presented which lead to an understanding of principle of parity conservation in β interactions. The asymmetry of the angular distribution of electrons emitted in β decay by oriented nuclei and the polarization of β radiation are analyzed. The new theoretical interpretation of the Landau theory and of the Lea and Yang two-component neutrino theory is discussed. (tr-auth)

11764

ANTIPROTONS IN NUCLEAR EMULSIONS. A. G. Ekspong, S. Johansson, and B. E. Ronne (Inst. of Physics, Uppsala). Nuovo cimento (10) 8, 84-91(1958) Apr. 1.

In one stack of nuclear emulsions exposed at the Bevatron, Berkeley, 10 events were found due to antiprotons. The interaction characteristics have been analyzed and are reported. Of special interest is the observation of an elastic collision between an antiproton and a free proton. (auth)

11765

ON TIME-IRREVERSIBLE NUCLEON-NUCLEON SCATTERING. R. J. N. Phillips (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuovo cimento (10) 8, 265-70(1958) Apr. 16.

The S-matrix for time-irreversible nucleon-nucleon scattering is parametrized by a simple extension of the phase-shift method. (auth)

11766

OBSERVATION OF PRODUCTION, DECAY, AND INTERACTION OF STRANGE PARTICLES. H. Blumenfeld, W. Chinowsky, and L. M. Lederman (Columbia Univ., New York and Brookhaven National Lab., Upton, N. Y.). Nuovo cimento (10) 8, 296-315(1958) Apr. 16.

The operation of the Columbia 35 in. magnet cloud chamber at the Cosmotron is described. The production of unstable particles by 1.9 Bev π^- pions in lead and carbon is studied. The yields are interpreted in terms of nuclear interactions of Λ^0 and θ^0 particles in the nucleus of production. A large cross section for the reaction $\Sigma \rightarrow \Lambda^0$ is deduced from this and other data. The disappearance of θ^0's is observed in lead relative to carbon, and possible mechanisms are discussed. The Λ^0 lifetime is redetermined to be $(2.75^{+0.45}_{-0.40}) \cdot 10^{-10}$ sec; that of the θ^0 is found to be $(1.15^{+0.40}_{-0.25}) \cdot 10^{-10}$ sec. Associated production is discussed and an upper limit for the fraction of Λ^0's associated with unknown particles is found to be 0.40. Correlation angles in Λ^0 decay are observed to favor "front-to-back" asymmetry. Some anomalous events are described. (auth)

11767

THE SOLUTIONS OF THE LOW EQUATION. I. D. B. Fairlie and J. C. Polkinghorne (Univ. of Edinburgh). Nuovo cimento (10) 8, 345-9(1958) Apr. 16.

The connection between the manifold of solutions of the Low equation for a non-relativistic system and the existence of "hidden structure" is exhibited. (auth)

11768

NUCLEAR FINE STRUCTURE WIDTHS AND SPACINGS. Sydel Blumberg and Charles E. Porter (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 110, 786-7(1958) May 1.

In recent years, high resolution measurements have led to a rather complete qualitative understanding of the statistical properties of nuclear fine-structure levels from an empirical point of view. Some recently obtained results are presented which show that both distributions can be derived from a single statistical hypothesis that the matrix elements of the Hamiltonian operator which defines the eigenstates of the compound nucleus follow normal distributions. (A.C.)

11769

REMARKS ON THE HYPERTRITON. R. H. Dalitz (Univ. of Chicago) and B. W. Downs (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 110, 958-65(1958) May 15.

The structure of the S states possible for a system consisting of a Λ particle and two nucleons is discussed, and criteria are laid down for a trial wave function suitable for describing the orbital motion. In order to obtain an upper bound for the Λ-nucleon interaction strength, variational calculations are carried through for the hypertriton with a simple trial function. Following the discussion of the results, it is concluded that it is very unlikely that there should exist bound states for the hyperdeuteron or for ${}_{\Lambda}He^3$. (auth)

11770

PROTON RELAXATION IN H_2O-D_2O MIXTURES CONTAINING PARAMAGNETIC IONS. A. I. Rivkind. Soviet Phys. (Doklady) 2, 30-1(1957) Jan.-Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 6559.

11771

NONSTATIONARY PHENOMENA IN NUCLEAR MAGNETIC RESONANCE. V. S. Grechishkin. Zhur. Eksptl'. i Teoret. Fiz. 34, 902-7(1958) Apr. (In Russian)

Vibration of a nuclear spin system induced by a single triangular pulse is considered. Transition processes due to frequency jumps which modelize the "beating of beats" phenomena are computed. It is demonstrated that a transition process in a spin system is determined only by the properties of the latter but not by the form of the radio frequency field. Formulas are obtained which can be employed to measure relaxation periods. (tr-auth)

11772

NON-CONSERVATION OF PARITY IN NEUTRINO CAPTURE BY PROTONS AND DEUTERONS. V. V. Anisovich Anisovich and A. A. Ansel'm (Leningrad Inst. of Physics in Technology). Zhur. Eksptl'. i Teoret. Fiz. 34, 995-7 (1958) Apr. (In Russian)

Equations are given for the cross sections of induced β-decay of protons $p + \nu \rightarrow n + e^+$ and deuterons $d + \bar{\nu} \rightarrow 2n + e^+$, assuming the polarization of the falling antineutrino target nuclei. (R.V.J.)

11773

TOTAL CROSS SECTIONS FOR FAST DEUTERON STRIPPING AND DIFFRACTION DISINTEGRATION ON NON-SPHERICAL NUCLEI. V. S. Popov. Zhur. Eksptl'. i Teoret. Fiz. 34, 1021-2(1958) Apr. (In Russian)

A nucleus with ellipsoidal shaped rotation and opaque to incident nucleons was studied. The kinetic energy of deuterons was taken sufficiently large to have the deuteron wave length shorter than the nuclear radius. The influence of the nuclear Coulomb field was not considered. (R.V.J.)

11774

DETERMINATION OF THE RELATIVE PARITY OF ELEMENTARY PARTICLES. Chzhou Guan-Chzhao. (Joint Inst. of Nuclear Studies). Zhur. Eksptl'. i Teoret. Fiz. 34, 1027-8(1958) Apr. (In Russian)

The parity of elementary particles was determined by means of strong interactions. The reaction $p(n) + He^4 \rightarrow {}_{\Lambda}He^5 + K^+(K^-)$, with the assumption that the spins of ${}_{\Lambda}He^5$ and K are equal to $\frac{1}{2}$ and 0, respectively, were used in the mathematical analysis. (R.V.J.)

Nuclear Properties

11775 CWR-495

Curtiss-Wright Corp. Research Div., Quehanna, Penna. CALCULATION OF CROSS-SECTIONS FOR INELASTIC SCATTERING OF NEUTRONS FROM Pb^{207} AND Pb^{208}. M. A. Rothman, and D. M. Van Patter. July 1957. 58p. Contract AT(30-3)-220. $9.30(ph OTS); $3.60(mf OTS).

The method of Hauser and Feshbach for calculating inelastic neutron cross-sections is described. Section I gives the general theory of the scattering process. Section II discusses the Hauser-Feshbach formula and the meaning of the various terms in it. In Section III the calculation of the transmission coefficients is discussed. Section IV outlines the procedure used in evaluating the Hauser-Feshbach formula. In Section V are discussed the level schemes for lead-207 and lead-208 and the methods by which they were determined. Sections VI and VII give the numerical results of the calculation for lead-207 and lead-208. Section VIII contains a discussion of the accuracy of the results and the comparison with the experimental observations. (auth)

11776

ALPHA UNSTABLE EXCITED STATE OF THE Be^8 NUCLEUS. V. Meyer and H. H. Staub (Univ. of Zurich). Helv. Phys. Acta 31, 205-20(1958). (In German)

The energy distribution of α particles resulting from the decay of Be^8 following the reaction $Li^7(p,\gamma)Be^8$ has been measured with a magnetic spectrograph in coincidence with the γ rays and also singly. The well known first excited state appears at a reduced energy of 2.8 Mev with a width of 1.9 Mev. No evidence of a fine structure of this level could be found. On the high energy side, for excitation energies between 4 and 9 Mev, no levels are present with intensities of more than 2% of the total number of excited Be^8 nuclei. (auth)

11777

ON THE AXIAL STABILITY OF A DEFORMED NUCLEUS. I. P. N. Mukherjee and I. Dutt (Inst. of Nuclear Physics, Calcutta). Indian J. Phys. 32, 165-73 (1958) Apr.

The energy eigenvalues of a single particle moving in an anisotropic harmonic oscillator potential have been calculated assuming that the equipotential surface coincides with the nuclear surface. It has been found that in the rare-earth region the shell model energy levels of a single particle depend sensitively on the deviation of the nuclear shape from cylindrical symmetry. Calculations have been done upto Ca^{40} core, and it is found that the energetically stable form of the nucleus corresponds to either $\gamma = 0$ or $2\pi/3$. It is also found that the total energy of an oblate nucleus is about 2 Mev greater than that of a prolate one, which is consistent with the observed positive excess of quadrupole moment in the rare-earth region. (auth)

11778

MEASUREMENT OF THE RATIO OF ABSORPTION CROSS-SECTION TO FISSION CROSS-SECTION FOR ^{233}U, ^{235}U, ^{239}Pu WITH 0·0011 eV NEUTRONS. S. J. Cocking (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nuclear Energy 6, 285-90 (1958) May.

The ratio of the absorption and fission cross-sections for these isotopes was measured by a new method which yields absolute values. The values obtained at 0.0011 ev are 1.113 ± 0.018; 1.172 ± 0.022 and 1.300 ± 0.040 for the isotopes U^{233}, U^{235}, and Pu^{239}, respectively. (auth)

11779

THE SLOW-NEUTRON RESONANCE BEHAVIOUR OF PLUTONIUM ISOTOPES. P. A. Egelstaff, D. B. Gayther, and K. P. Nicholson (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nuclear Energy 6, 303-21(1958) May.

The neutron total cross-sections of several plutonium samples were measured from 0.02 ev to 51 kev, using the Harwell fast chopper. The samples contained various abundances of Pu^{239}, Pu^{240}, Pu^{241}, and Pu^{242}, making it possible in most cases to assign an observed resonance level to its particular isotope. The maximum resolution of the spectrometer was 0.11 μsec/m, and at energies below about 40 ev resonance parameters were obtained for the identified levels using the area method of analysis. The distributions of neutron widths and level spacings in Pu^{239} are compared with theoretical predictions. A value of $(1.3 \pm 0.2) \times 10^{-4}$ for the ratio of average reduced neutron width to average level spacing, $\Gamma^0/n\bar{D}$, is deduced from the observed average cross-section of Pu^{239} above 500 ev. The value of $\Gamma^0/n\bar{D}$ obtained from the separate parameters measured at low energies is $(1.0 \pm 0.2) \times 10^{-4}$. The fluctuations in the observed cross-section are analyzed in terms of theoretical distributions in neutron widths and level spacings. (auth)

11780

THE MASS OF ^3He. R. A. Demirkhanov, T. I. Gutkin, V. V. Dorokhov. J. Nuclear Energy 6, 371-2(1958) May.

The isotopic mass of He^3 was determined by mass spectrometry. A mixture of helium isotopes, with the He^3 content enriched to 99.5%, was used in the measurement. (W.D.M.)

11781

DETERMINATION OF THE HYPERFINE STRUCTURE AND THE ZEEMAN g_J FACTOR OF THE ^2D GROUND STATE OF Y^{89} BY THE ATOMIC RADIATION RESONANCE METHOD. G. Fricke (Inst. für technische Kernphysik der Technischen Hochschule, Darmstadt) and H. Kopfermann and S. Penselin (Univ. of Heidelberg). Naturwissenschaften 45, 237-8(1958). (In German)

For determination of the g_J factors of both ground states, the $\Delta F = 0$ transitions $(1,0) \leftrightarrow (1,-1)$ and $(2,1) \leftrightarrow (2,0)$ of the $^2D_{5/2}$ state as well as $(2,0) \leftrightarrow (2,-1)$ and $(3,1) \leftrightarrow (3,0)$ of the $^2D_{3/2}$ state were measured together with the $\Delta F = 0$ transition $(1,0) \leftrightarrow (1,1)$ of the ground state of Ag^{107} at equal C field strengths ($H_C \cong 500$ gauss). The results were $g_J(Y^{89}) = 0.79927 \pm 0.00011$ for the $^2D_{5/2}$ state and 1.20028 ± 0.00019 for the $^2D_{3/2}$ state. The A factor of both ground states was calculated as $A(^2D_{5/2}) = -(57.217 \pm 0.015)$ and $A(^2D_{3/2}) = -(28.749 \pm 0.030)$ MHz. (J.S.R.)

11782

LEVELS IN Dy^{161}. I. EXPERIMENTAL INVESTIGATION OF THE DECAY OF Tb^{161}. P. Gregers Hansen, O. Nathan, O. B. Nielsen, and R. K. Sheline (Univ. of Copenhagen). Nuclear Phys. 6, 630-44(1958) May.

The decay of Tb^{161} has been reinvestigated by means of scintillation spectrometers, a six-gap β-ray spectrometer, and coincidence techniques. The following transitions were observed (energies in kev): 25.6 (E1), 28.7, 48.9 (M1), 57.1 (M1), 74.5 (E1), 77.6, 106 (M1 or E2), 132 (tentative). Lifetime measurements and coincidence experiments show unambiguously the existence of levels in Dy^{161} with energies of 25.6, 74.5, and 132 kev. A level has tentatively been placed at 103.3 kev. The half lives of the 25.6 and 74.5 kev states are $(2.8 \pm 0.2) \times 10^{-8}$ sec and $(3.0 \pm 0.3) \times 10^{-9}$ sec. The β spectrum contains a ground state transition with end point at (610 ± 15) kev and groups of (525 ± 15) and (460 ± 15) kev to the 74.5 and 132 kev levels. (auth)

11783

LEVELS IN Dy^{161}. II. THEORETICAL. Daniel R. Bès (Univ. of Copenhagen). Nuclear Phys. 6, 645-54(1958) May.

The experimental evidence on Dy^{161} is shown to be in accord with the predictions of the unified model. Certain effects due to the Coriolis force are verified. (auth)

11784

INVESTIGATION OF THE LIFE-TIMES OF LOWER NUCLEAR LEVELS EXCITED IN ELECTRON CAPTURE. E. Ye. Berlovich, K. Grotovski, M. Bonitz, V. I. Breslav, and B. K. Preobrazhensky (Physico-Tech. Inst. of the USSR Academy of Sciences, Leningrad). Nuclear Phys. 6, 672-85(1958) May.

On the basis of X-e and X-γ coincidence studies the following half-life values have been found for levels excited in electron capture: 264 kev level in Er^{167}: $T_{1/2} = (2.0 \pm 0.5) \times 10^{-9}$ sec; 121 kev level in Sm^{147}: $T_{1/2} \leq 2 \times 10^{-10}$ sec; 186 kev level in Os^{190}: $T_{1/2} = (5 \pm 2) \times 10^{-10}$ sec; level of gadolinium (half life 60 days): $T_{1/2} = (3.5 \pm 1.1) \times 10^{-10}$ sec. Compared with predictions of the one-particle model, the investigated E2 transition in Os^{190} and the partial E2 transition in Er^{167} are accelerated respectively 50 and 300 times and the partial M1 transition is retarded 160 times. The intrinsic quadrupole moment of Os^{190} is $Q_0 = (4.2 \pm 0.9) \times 10^{-24}$ cm^2. (auth)

11785

THE EFFECTIVE CROSS SECTION OF Pu^{240} IN LONG-TERM REACTIVITY CALCULATIONS. R. L. Crowther and J. W. Weil (General Electric Co., Pleasanton, Calif.). Nuclear Sci. and Eng. 3, 747-57 (1958) June.

The presence of a large, sharp resonance at 1 ev in Pu^{240} results in the effective pile cross section for this isotope being very much larger than the true thermal cross section. Furthermore, the narrowness of this resonance causes the absorption of epithermal neutrons in Pu^{240} to be strongly self-shielded. Consequently, the effective cross section of Pu^{240} will be a function of reactor spectrum and of the Pu^{240} concentration at any given time. The significance of this effect can be appreciated by noting that the effective cross section of this isotope is frequently more than twice the effective thermal value. An approximate method of calculation was applied to long term reactivity problems. The importance of the resonance augmentation and concentration dependence of the Pu^{240} cross section is particularly evident in the first few thousand Mwd/t and causes significant changes in the reactivity required to reach any longer burnout. Sample calculations are presented and comparisons with the Canadian experimental determinations of the effective Pu^{240} cross section are made. An effective constant Pu^{240} cross section is presented which will yield approximately correct burnout results when used in conventional irradiation studies. (auth)

11786

SUBCADMIUM IN-PILE ETAS AND ABSORPTION CROSS SECTIONS OF U^{233}, Pu^{239}, AND Pu^{241}. E. R. Gaerttner, M. E. Jones, D. E. McMillan, J. B. Sampson, and T. M. Snyder (General Electric Co., Schenectady, N. Y.). Nuclear Sci. and Eng. 3, 758-71(1958) June.

Measurements of two independent types were made of the reactivity effect in a thermal test reactor of samples of U^{235}, U^{233}, Pu^{239}, and Pu^{241}. From these measurements average subcadmium values of eta ($\bar{\eta}$) relative to $\bar{\eta}$ of U^{235} are obtained independently of other knowledge of the average absorption cross sections. Average absorption cross sections are also obtained from the measurements. Values of ($\bar{\eta}$) for U^{233}, Pu^{239}, and Pu^{241} are respectively 2.231 ± 0.034, 1.927 ± 0.024, and 2.213 ± 0.07. The corresponding value of η (0.0253 ev) of Pu^{239} is found to be 2.025. A presentation of the method and results are given together with a comparison with previous work. (auth)

11787

EQUILIBRIUM SPECTRUM AND DIFFUSION LENGTH IN NATURAL URANIUM. D. Meneghetti, H. H. Hummel, and W. B. Loewenstein (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 3, 772-3(1958) June.

Calculated and measured cross sections for $Pu^{239}(n,f)$, $U^{235}(n,f)$, $U^{233}(n,f)$, $Np^{237}(n,f)$, $U^{238}(n,\gamma)$, and $Au^{197}(n,\gamma)$ are compared. The calculated value of the equilibrium diffusion length in natural uranium of 8.5 cm is compared to the measured value of 9.6 to 10.0 cm. To bring the calculated and measured values into agreement would require a reduction of about 30% in the cross section of U^{238}. (W.D.M.)

11788

ON THE DECAY OF ^{133}Ba. R. K. Gupta, S. Jha, M. C. Joshi, and B. K. Madan (Tata Inst. of Fundamental Research, Bombay). Nuovo cimento (10) 8, 48-59 (1958) Apr. 1.

The results of β-ray spectrometer studies and scintillation spectrometer studies of Ba^{133} are presented. A new level in Cs^{133} at 160 kev has been found. The γ rays of energies 56, 79, 160, 224, 277, 302, 358, 383, and 437 kev have been detected. The conversion coefficients of some of the γ rays have been estimated. It has been found by a combination of the summing technique and the conventional coincidence technique that Ba^{133} decays with an energy of (53 ± 2) kev to the 437 kev state of Cs^{133} by K-electron captures (46%) and L-electron captures (54%). A decay scheme is suggested. (auth)

11789

SINGLE-PARTICLE ENERGY AND EFFECTIVE MASS AND THE BINDING ENERGY OF MANY-BODY SYSTEMS. Keith A. Brueckner (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 110, 597-600(1958) May 1.

The relationship between the single-particle energy and effective mass and the binding energy of the many-particle nuclear system is discussed. It is shown that only in the case of first order perturbation theory is it possible to define a physically meaningful single-particle energy E(p) so that both relationships, $E(p_F) = (p^2/2M) + V(p_F) = E_{average}$ and $NE_{average} = (p^2/2M)_{average} + \frac{1}{2}[V(p)]_{average}$, are satisfied. More generally a correction term appears, as a result of important many-body contributions to the single-particle energy which arise from the effects of the exclusion principle and from the variation of the self-consistent excitation spectrum with density. The principal effect of the correction is to alter the relationship between $E_{average}$ and the average value of the single-particle energy. Analysis of the optical potential which determines the momentum of a nucleon interacting with the nucleus shows that the same correction term again appears, changing the usual definition of the optical potential. An additional consequence is that it is not possible to fix the effective mass for particle motion from knowledge of the average binding energy and kinetic energy alone, the first order theory underestimating the effective mass by 38% in nuclear matter and by 77% in liquid He^3. (auth)

11790

NUCLEAR QUADRUPOLE COUPLING CONSTANTS OF

Li^7 IN LITHIUM COMPOUNDS. John F. Hon and P. J. Bray (Brown Univ., Providence). Phys. Rev. 110, 624-9 (1958) May 1.

Quadrupolar splittings of the Li^7 nuclear magnetic resonance have been detected and measured in powders of LiOH, $LiOH \cdot H_2O$, $LiNO_3$, $LiNO_3 \cdot 3H_2O$, $LiIO_3$, Li_3PO_4, Li_2TiO_3, and Li_2ZrO_3. The theoretical powder pattern for a nonvanishing asymmetry parameter, η, has been checked by observations in spodumene, $LiAl(SiO_3)_2$, and applied in the analysis of several of the observed spectra. It was found necessary to shorten the Li^7 spin-lattice relaxation time, T_1, in most of the compounds before successful measurements could be made. (auth)

11791

NUCLEAR RADII BY SCATTERING OF LOW-ENERGY NEUTRONS. K. K. Seth, D. J. Hughes, R. L. Zimmerman, and R. C. Garth (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 110, 692-700(1958) May 1.

The potential scattering cross section for slow neutrons, σ_p, has been measured for seventeen elements in order to determine the nuclear potential radius and to investigate the predictions of nuclear optical models. The measurements were based on total cross sections resulting from transmission experiments performed with the Brookhaven fast chopper. In the energy region where individual resonances can be resolved and their parameters determined with reasonable accuracy, σ_p is obtained by subtracting the resonance contribution, including interference effects, from the measured total cross section. In the kev region, where the chopper resolution permits determination of cross sections averaged over many resonances only, different sample thicknesses are used and σ_p derived from the slope of the transmission curve. The results in the two energy regions agree, thereby justifying the concept of potential scattering as a cross section constant with energy, once effects of nearby resonances are removed. The variation of potential scattering with atomic weight is compared with predictions of optical models of the nucleus. The data reflect rather strongly the effects of the deformation of the nuclear shape from spherical, and good agreement is obtained for a potential well with a diffuse surface and nuclear deformations corresponding to known quadrupole moments. The radius of the potential (the distance in its half-value) is given by $R = r_0 A^{1/3}$, with $r_0 = (1.35 \pm 0.04) \times 10^{-13}$ cm. The radius parameter r_0 is thus distinctly larger than the 1.09×10^{-13} cm obtained from electron scattering experiments. (auth)

11792

GYROMAGNETIC RATIO OF 2^+ ROTATIONAL STATES. G. Goldring and R. P. Scharenberg (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 110, 701-7(1958) May 1.

The angular distribution of gamma rays following Coulomb excitation of millimicrosecond 2^+ states in Nd^{150}, Sm^{152}, Sm^{154}, Gd^{154}, and Gd^{160} were investigated. The gamma-ray angular distributions from solid oxide targets showed substantial perturbations. The attenuation coefficients for liquid nitrate targets were measured to be: Nd^{150}, $G_2^1 = 1 \pm 0.035$; Sm^{152}, $G_2^1 = 1 \pm 0.035$; Sm^{154}, $G_2^1 = 1.1 \pm 0.10$; Gd^{154}, $G_2^1 = 0.5 \pm 0.06$, Gd^{156}, $G_2^1 = 0.6 \pm 0.04$; Gd^{160}, $G_2^1 = 0.6 \pm 0.06$. The influence of the paramagnetic ion and the liquid environment on the angular distributions are discussed. The effect of an external magnetic field (H_{ex}) on the unperturbed gamma-ray angular distribution from liquid targets was measured. The effect was attributed to the precession of the excited nucleus (gyromagnetic ratio g) in the external magnetic field that has been modified by the atomic structure (H_{eff}). For Nd^{150}, $H_{eff} = (2.3 \pm 0.3)H_{ex}$, $g = 0.22 \pm 0.04$; Sm^{152}, $H_{eff} = (1.7 \pm 0.2)H_{ex}$, $g = 0.21 \pm 0.04$; Sm^{154}, $H_{eff} = (1.7 \pm 0.2)H_{ex}$, $g = 0.21 \pm 0.04$. (auth)

11793

ATOMIC MASSES FROM PHOSPHORUS THROUGH MANGANESE. Clayton F. Giese and Jay L. Benson (Univ. of Minnesota, Minneapolis). Phys. Rev. 110, 712-20(1958) May 1.

Atomic masses of all the stable isotopes of the elements from phosphorus through manganese have been measured with the large double-focusing mass spectrometer at this laboratory. The comparison with previous mass spectroscopic results presents a varying pattern of agreement and disagreement. The disagreement of the present mass measurements with results from microwave spectroscopy is, in general, good. The present masses agree much better with Q-value determinations than do previous masses. The remaining differences appear to be systematic. It would appear to be symptomatic of the discrepancies that in all cases, 10 in number, in which a (p,α) Q-value can be predicted from the present measured masses, the measured Q-value is less than the predicted value. The paper includes a tabulation of masses of unstable nuclei. In addition, tables and plots of nucleon separation and total nucleon pairing energies for this mass region are included. (auth)

11794

INHIBITION OF M1 γ TRANSITIONS WITH $\Delta T = 0$ IN SELF-CONJUGATE NUCLEI. G. Morpurgo (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 110, 721-5(1958) May 1.

It is shown that the strengths of M1 γ transitions with no change of isotopic spin in self-conjugate nuclei may be expected to be smaller by a factor 100 than the normal M1 strengths; the reason is that the matter element for the particular M1 transitions mentioned above is considerably reduced owing to an almost complete cancellation of the protonic, neutronic, and orbital magnetic moments. A number of experimental confirmations of the above rule are discussed. (auth)

11795

DECAY SCHEME OF 50-DAY Re^{184}. C. J. Gallagher, Jr., D. Strominger, and J. P. Unik (Univ. of California, Berkeley). Phys. Rev. 110, 725-32(1958) May 1.

A detailed study of the radiations of Re^{184} decay is given. The decay is found to be complex, with most of the direct decay populating the 2+ and 3+ levels at 904 and 1006 kev in W^{184}. A decay scheme is presented which includes all of the strong transitions, but several weak transitions remain unplaced. Several tests of the unified-model predictions are made. Data on the K-Auger electrons of tungsten are given. Some incidental studies of Re^{183} are also presented. The half life value of Re^{183} is found to be 71 days, in disagreement with previous values. (auth)

11796

SPIN-ORBIT CONTRIBUTIONS IN THE LOW-ENERGY n-p TRIPLET POTENTIALS. Roger G. Newton and James H. Scofield (Indiana Univ., Bloomington). Phys. Rev. 110, 785-6(1958) May 1.

11797

HYPERFINE STRUCTURE OF TECHNETIUM-99 FROM PARAMAGNETIC RESONANCE. W. Low and P. M. Llewellyn (Univ. of Chicago, Ill.). Phys. Rev. 110, 842-3(1958) May 15.

The hyperfine structure of tetravalent Tc^{99} in a single crystal of K_2PtCl_6 was detected at 1.25 cm wavelength and at the temperature of the boiling point of liquid

helium. The significant parameters are: $g = 1.9896 \pm 0.0005$, $A_{max} = 148.8 \pm 0.4$ gauss, $A_{min} = 144.0 \pm 0.4$ gauss. The nuclear spin is confirmed as $^5/_2$. An additional six isotropic lines with $g = 2.050 \pm 0.005$ and $A = 109 \pm 3$ gauss are found at liquid nitrogen temperature. These hyperfine lines may possibly be due to the rhenium isotopes 185 and 187 with nuclear spins $^5/_2$. (auth)

11798

NUCLEAR MAGNETIC RESONANCE IN THE CESIUM HALIDES. N. Bloembergen and P. P. Sorokin (Harvard Univ., Cambridge, Mass.). Phys. Rev. 110, 865-75 (1958) May 15.

The chemical shifts, the spin-lattice relaxation times, the isotopic exchange coupling $\tilde{A}$, and the pseudo-dipolar exchange coupling $\tilde{B}$ between cation and anion nuclear spins were determined in a single crystal of CsBr. The results are: $\sigma_{Cs} = (-1.9 \pm 0.4) \times 10^{-4}$, $\sigma_{Br} = (-2.5 \pm 0.3) \times 10^{-4}$, $(T_1)_{Cs} = 1050 \pm 40$ sec, $(T_1)_{Br} = 0.105 \pm 0.020$ sec, $h^{-1}|\tilde{A}| = 55$ sec^{-1}, $h^{-1}|\tilde{B}| = 15$ or -89 sec^{-1}. Similiar, but less complete, data were obtained for a single crystal of CsI and a CsCl powder. (W.D.M.)

11799

LIFETIME OF THE FIRST EXCITED STATE OF B^{11}. F. R. Metzger, C. P. Swann, and V. K. Rasmussen (Franklin Inst., Swarthmore, Penna.). Phys. Rev. 110, 906-9(1958) May 15.

Using the reaction $B^{11}(p,p')B^{11*}$ as the source of Doppler-broadened 2.14-Mev gamma radiation, resonance fluorescence from the first excited state of B^{11} has been observed. For a bombarding energy of 3.0 Mev and a thick target of B_4C, the shape of the cone containing gamma rays capable of exciting the 2.14-Mev level was determined. It agrees with the expectation based on the known excitation curve and the kinematics of the $B^{11}(p,p')$ reaction assuming an isotropic distribution of the B^{11*} recoils. From the experimental resonance scattering cross section a mean life of 4.8×10^{-15} second was calculated for the first excited state of B^{11}, assuming the spin of this level to be $^1/_2$. A self-absorption experiment yielded $\tau_\gamma = 4.3 \times 10^{-15}$ second when a value of 1250° was used for the Debye temperature of B_4C. A final value of $(4.7 \pm 0.6) \times 10^{-15}$ second was adopted for the mean life on the 2.14-Mev first excited state of B^{11}. This value of the lifetime further strengthens the argument for spin $^1/_2$, but it does not allow any conclusion about the M1 or E1 character of the gamma-ray transition and thus about the parity of the 2.14-Mev level. (auth)

11800

NUCLEAR LEVELS EXCITED BY INELASTIC NEUTRON SCATTERING. F. I. Boley, E. H. Thorndike, and A. T. Moffet (Wesleyan Univ., Middletown, Conn.). Phys. Rev. 110, 915-22(1958) May 15.

Gamma-ray, neutron, and gamma-gamma coincidence spectra have been obtained from inelastic interactions of 2.48-Mev neutrons with P^{31}, Mn^{55}, Co^{59}, As^{75}, Nb^{93}, and Bi^{209}. The following previously unreported gamma rays have been observed: Co^{59} 2.11 ± 0.05, 0.698 ± 0.015, 0.559 ± 0.022, 0.132 ± 0.010 Mev; As^{75} 1.81 ± 0.04, 1.61 ± 0.04, 1.32 ± 0.04 Mev; Nb^{93} 2.11 ± 0.08, 1.94 ± 0.07, 1.52 ± 0.04, 0.345 ± 0.017 Mev. Evidence has been found for the existence of a 1.56 ± 0.03 Mev level in Mn^{55} and possibly a 1.02 ± 0.05 Mev level in As^{75}. The following previously unreported coincidences have been observed: Co^{59} 0.132–2.11 Mev; and As^{75} 0.578–0.136 Mev. (auth)

11801

NEUTRON TOTAL CROSS SECTIONS IN THE 7- TO 14-Mev REGION. A. Bratenahl, J. M. Peterson, and J. P. Stoering (Univ. of California, Livermore). Phys. Rev. 110, 927-36(1958) May 15.

The neutron total cross sections for 35 elements and isotopes were measured at several energies between 7 and 14 Mev using monoenergetic neutrons produced by the Livermore variable-energy cyclotron through the $D(d,n)He^3$ reaction. The effects of beam contamination by gamma rays and low-energy "breakup" neutrons were evaluated through time-of-flight measurements and were kept small by suitably high bias on the plastic scintillator detector. The accuracy of the cross sections is typically ±1 to 2%. Where comparisons with previous data are possible, the agreement ranges from excellent to poor (10% discrepancy). The data form a smooth cross-section surface when plotted versus energy and mass number, as expected on the basis of the optical model. The functional dependence on energy and mass is not simple but is in good agreement with the predictions of the optical model of Bjorklund and Fernbach. (auth)

11802

9.51-Mev LEVEL IN N^{14}. D. M. Zipoy (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 110, 995(1958) May 15.

The radiative decay angular distributions from the 9.51-Mev state in N^{14} are inconsistent with the spin assignment of J = 3 but are consistent with a J = 2 assignment. Because of this discrepancy, the analysis of the elastic scattering data was redone with the result that the assignment of $J^\pi = 2^-$ does give a better fit than $J^\pi = 3^-$. (W.D.M.)

11803

HYPERFINE STRUCTURE OF DEUTERIUM AND NUCLEON-NUCLEON SPIN-ORBIT POTENTIALS. A. M. Sessler (Ohio State Univ., Columbus). Phys. Rev. 110, 995-6(1958) May 15.

The hyperfine structure of deuterium is a very sensitive indicator of the amount of spin-orbit forces in the deuteron, and even with the present theoretical uncertainty in the interpretation of the hfs, it affords a limitation on the amount of magnetic moment arising from spin-orbit forces which proves to be more severe than that afforded by mere examination of the magnetic moment of the deuteron. (W.D.M.)

11804

THE NUCLEAR ISOMERISM OF Hf^{180m}. V. S. Gvozdev and L. I. Rusinov. Soviet Phys. (Doklady) 2, 35-8(1957) Jan.-Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 6514.

11805

PARAMAGNETIC RESONANCE HYPERFINE STRUCTURE, NUCLEAR SPIN AND THE MAGNETIC MOMENT OF THE 5.3-YEAR RADIOACTIVE ISOTOPE Eu^{152}. A. A. Manenkov, A. M. Prokhorov, P. S. Trukhliaev, and G. N. Iakovlev. Soviet Phys. (Doklady) 2, 64-6 (1957) Jan.-Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 6515.

11806

THE MEASUREMENT OF TOTAL CROSS SECTIONS σ_t FOR 14.8-Mev NEUTRONS BY (n,α) COINCIDENCES. M. M. Khaletskii (Inst. of Chemical Physics, Academy of Sciences, USSR). Soviet Phys. (Doklady) 2, 129-30 (1957) Mar.-Apr.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 9048.

11807
DETERMINATION OF DIFFERENTIAL ELASTIC SCATTERING CROSS SECTIONS FOR 14.8-Mev NEUTRONS BY (n,α) COINCIDENCES. M. M. Khaletskii (Inst. for Chemical Physics, Academy of Sciences, USSR). Soviet Phys. (Doklady) 2, 152-3(1957) Mar.-Apr.

The differential elastic scattering cross sections for lead, tin, iron, aluminum, and carbon for 14.8-Mev neutrons were measured by the (n,α) coincidence method. The neutron source was the $D^2(T,n)He^4$ reaction. The alpha particles were emitted by the source at 135° to the deuteron beam and were recorded. After emerging from the target the neutrons, correlated with the alpha particles, crossed a narrow channel through the shield. The shield reduced the count of random (n,α) coincidences. Behind the shield were scatterers which were shifted in and out of the neutron beam by a special device. The neutrons were measured by a toroidal liquid scintillation counter. For variation of the angle at which neutron scattering was being investigated the torus was shifted with respect to the scatterers. (J.S.R.)

11808
Cd(n,p)Ag CROSS SECTIONS WITH 14-Mev NEUTRONS. V. N. Levkovskii (Inst. for Chemical Physics, Academy of Science, USSR). Soviet Phys. (Doklady) 2, 182-3 (1957) Mar.-Apr.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 10250.

11809
NUCLEAR SPIN OF Fe^{57}. N. S. Garif'yanov, M. M. Zaripov, and B. M. Kozyrev (Physico-Tech. Inst., Kazan Branch, Academy of Sciences, USSR and V. I. Ul'ianov-Lenin Kazan State Univ.). Soviet Phys. (Doklady) 2, 195(1957) Mar.-Apr.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 10251.

11810
NUCLEAR ISOMERISM AND STRUCTURE OF ATOMIC NUCLEI. L. I. Rusinov and G. M. Drabkin. Uspekhi Fiz. Nauk 64, No. 1, 93-112(1958) Jan. (In Russian)

Properties of isomeric nuclei were correlated with the data obtained with the generalized nuclear mode. Isomeric transitions and half lives are given for 33 isotopes. (R.V.J.)

11811
THE DETERMINATION OF THE β HALF LIFE OF Lu^{176} BY THE DETECTION OF RADIOGENIC Hf^{176}. W. Herr and E. Merz (Max-Planck-Institut für Chemie, Mainz) and P. Eberhardt and P. Signer (Univ. of Bern). Z. Naturforsch. 13a, 268-73(1958) Apr. (In German)

A re-examination of the half life of lutetium was carried out by an analysis of the probable decay products, and the applicability of this β radioactivity for geological dating was tested. In various rare earth minerals the lutetium and hafnium content, as well as the isotopic abundance of hafnium, was determined. In a gadolinite mineral radiogenic Hf^{176} was detected. The mineral age of this mineral was determined. Under the assumption that the possibility of K capture in place of the beta decay of Lu^{176} could be ignored, the half life of Lu^{176} was calculated to be $(2.17 \pm 0.35) \times 10^{10}$ yr. (tr-auth)

11812
THE GYROMAGNETIC RATIO OF THE 92 kev LEVEL OF Pm^{147}. E. Bodenstedt, E. Matthias, H. J. Körner, and R. H. Siemssen (Univ. of Hamburg). Z. Naturforsch. 13a, 425-6(1958) May. (In German)

The angular correlation of the 320 kev-92 kev cascade was measured with an exterior magnetic field of 37,200 gauss for both field directions and was compared with the angular correlation without external field. A definite displacement of the angular correlation curve was observed, and the g-factor was determined to be $g = 0.43 \pm 0.15$. The conditions of the measurements are described and the possible errors discussed. (J.S.R.)

11813
NEAR-HARMONIC STRUCTURE AND LEVEL SIMILARITIES IN Fe^{56}, Fe^{58} AND Ni^{60}. N. Levine, H. Frauenfelder, and A. Rossi (Univ. of Illinois, Urbana). Z. Physik 151, 241-51(1958).

Near-harmonic structure is known to exist in Fe^{58}, and an investigation was undertaken to determine whether this structure is also present in Fe^{56} and Ni^{60}. In the case of Fe^{56}, no second 2^+ state with the desired energy or de-excitation characteristics had been reported by previous investigators and a search for a small excitation of such a level from the decay of Mn^{56} is described. The results are inconclusive although some evidence for its existence is presented. The investigation of the $Mn^{56}-Fe^{56}$ decay reveals the presence of an additional beta branch to a 2^+ level at 3.34 Mev in Fe^{56}. The results of the angular correlation measurements on the cascade gamma rays from this and other levels are given. The stopover transitions are found to be mostly M 1 radiation and hence not of the near-harmonic type. In the case of Ni^{60}, the measured angular correlation functions for the 0.85 to 1.33 and 1.76 to 1.33 Mev cascades initiated from the decay of Cu^{60} are reported. For the former cascade, the results indicate that the stopover transition is largely E2 radiation, but the experimental difficulties prevent a more quantitative statement. The presence of this type of radiation, together with a stopover to crossover intensity ratio of 15, imply the existence of near-harmonic structure in Ni^{60}. The angular correlation function for the latter cascade in Fe^{58} which lends weight to the contention that there exist level similarities in these nuclei. Additional evidence for these similarities is also presented. (auth)

11814
INTERNAL CONVERSION ELECTRON STUDY OF THE LOWER EXCITED LEVELS OF U^{235}. E. F. Tretyakov, G. I. Grishuk, and L. L. Goldin. Zhur. Eksptl'. i Teoret. Fiz. 34, 811-19(1958) Apr. (In Russian)

The internal conversion electrons emitted by excited U^{235} nuclei following the α decay of Pu^{239} nuclei were investigated. Multipolarities of the transitions were established and the spins and parities of the first 6 levels were determined by comparing the results with the theoretical internal conversion coefficients for the L_I and L_{II} shells. It is shown that the first 5 levels form a rotational band with $K = \frac{1}{2}$. The excited state energy levels were corrected. (tr-auth)

Nuclear Reactors

Refer also to abstracts 11259 and 12100.

11815 AECU-3694
Knolls Atomic Power Lab., Schenectady, N. Y.
STEADY STATE PERFORMANCE OF A THERMAL CIRCULATION LOOP CONTAINING A PARALLEL PATH HEAT SINK. J. J. Foster. Jan. 31, 1958. 12p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40 (mf OTS).

The steady-state performance of thermal circulation loops with parallel path heat sinks has been studied to determine what the system design and arrangement

objectives are for such a loop. Though all heat sink paths may have thermal centers above the heat source thermal center, flow reversal through some of the paths may nevertheless occur. Such reversal can result in reduced performance if not in complete flow cessation if the improper type of arrangement design has been chosen. Assumptions normally used with present analytical techniques would mask this unfavorable effect. The analysis presented can be utilized to detect and avoid a flow reversal. In addition, a satisfactory system design and arrangement of such a loop can be achieved with a reduced number of required trials. (auth)

11816 AERE-R/M-161

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

AN ESTIMATE OF THE REACTIVITY CHANGE IN DIDO DUE TO A CHANGE IN THE ISOTOPIC PURITY OF THE HEAVY WATER. C. J. England. Jan. 1958. 14p.

One-group lattice calculations and two-group criticality calculations have been performed assuming three different isotopic purities for the heavy water in the reactor DIDO. From these calculations it is estimated that the reactivity change due to a small change in the isotopic purity of the heavy water is $-0.9\%(\delta k_{eff}/k_{eff})$ per 0.1% degradation in D_2O purity. (auth)

11817 AERE-R/R-2506

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

CALCULATION OF DOPPLER BROADENING EFFECTS IN HOMOGENEOUS Th^{232} AND U^{238} SYSTEMS. J. P. H. Blake and G. A. Hughes. Mar. 1958. 25p. (HTGC-Memo-30; HTR/PWP/P-5).

A method of calculation which allows the effect of temperature variations on resonance escape probability to be approximated is given. Results are given for homogeneous mixtures of U^{238} or Th^{232} with a scattering medium over a wide range of temperature. (T.R.H.)

11818 AERE-T/R-114

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

ESTIMATES OF THE EFFECTIVENESS OF THE CONTROL AND SAFETY RODS FOR GLEEP. C. A. Rennie. July 1947. Decl. Apr. 16, 1958. 8p.

Estimates are made of the change in the multiplication factor as controlled by the control and safety rods in GLEEP. The case of a rod perpendicular to the axis of the pile was considered as it is simpler to treat theoretically. Also the reacting core was assumed to be homogeneous. Curves showing the effectiveness of a rod of given dimensions as a function of its distance from the curve of the pile are given. (J.S.R.)

11819 APAE-23

Alco Products, Inc., Schenectady, N. Y.

APPR-1: DESIGN, CONSTRUCTION AND OPERATION. Nov. 20, 1957. 175p. Contract AT(11-1)-318. $3.00 (OTS).

Papers presented at the Second Winter Meeting of the American Nuclear Society on October 28, 1957 in New York City are presented. Included are papers on Army Package Power Reactor design and construction, core loading calculations and experiments, zero power experiments, heat removal calculations and experiments, mechanical design features, shield design and measurements, startup and operation, and water treatment and waste disposal. (D.E.B.)

11820 APAE-Memo-108

Alco Products, Inc., Schenectady, N. Y.

COOLANT FLOW TAILORING PROGRAM OF THE APPR-1 CORE EMPLOYING A FULL SCALE MODEL OF THE REACTOR VESSEL. Salvatore M. Ingeneri. Nov. 15, 1957. 68p. Contract AT(11-1)-318. $1.75 (OTS).

Experimental data obtained from the simulating air flow rig indicated that though the fluid entering the fuel elements and control rods from the plenum chamber follows a rather random behavior, there is, however, a fairly consistent distributional pattern. Thus, fuel elements located equidistant from the core center may require different orifice diameters to meet a given flow requirement. This, in fact, is apparent from the final orifice diameter schedule which was recommended. Control of flow into the control rods was accomplished by restricting the flow into the fuel elements, thus allowing more fluid to enter the rods. Orificing or direct forms of flow regulation were not used on the control rods since their geometry was not conducive to installation of control means, and also because of the satisfactory results obtained without resort to flow control devices. The effect of the orifice schedule on the coolant flow distribution in the core is shown. These curves are based on the average of V/V_{avg} values determined from experimental data for families of fuel elements and control rods located at specific core radii. It should be noted that the final recommended orifice schedule is an attempt to further refine the nearly satisfactory flow distribution obtained with the 3rd orifice plate. (auth)

11821 CF-54-8-237

Oak Ridge School of Reactor Technology, Tenn.

A TEN MEGAWATT BOILING HETEROGENEOUS PACKAGE POWER REACTOR. Reactor Design and Feasibility Problem. M. A. Rosen, D. B. Coburn, T. A. Flynn, E. H. Hemmerle, C. E. Klotz, J. MacPhee, T. W. McIntosh, G. K. Rhode, and J. R. Struyk. Aug. 1954. Decl. Nov. 1957. 248p.

A reactor and associated power plant designed to produce 1.05 Mwh and 3.535 Mwh of steam for heating purposes are described. The total thermal output of the reactor is 10 Mwh. The fuel plates consist of highly enriched UO_2 imbedded in a matrix of stainless steel and clad on all sides with stainless steel. The core is cooled and moderated by naturally circulated, boiling, light water. At full power the core has an average void fraction of 20% by volume in the coolant. The saturated steam, at 415 psia and 448.2°F, is used to drive a turbogenerator. This steam is also used to generate non-radioactive steam for space heating. The reactor is loaded with 18.1 kg of U^{235} and will supply 15 Mw-years of energy before refueling is required. This corresponds to 2.5 years of operation at an average load factor of 60%. Burnout poison in the form of B_4C is incorporated to reduce the reactivity excursion and thus facilitate control. The estimated capital investment is $1,258,400. The estimated cost per kw-hour for net electric and steam power at the bus, based on a 60% load demand is 4.43 cents and 1.08 cents, respectively. (auth)

11822 CF-57-8-12

Oak Ridge School of Reactor Technology, Tenn.

GAS COOLED PEBBLE BED REACTOR FOR A LARGE CENTRAL STATION. Reactor Design and Feasibility Study. A. Schock, D. F. Bruley, H. N. Culver, P. W. Ianni, W. F. Kaufman, R. A. Schmidt, and R. E. Supp. Aug. 1957. 323p. $5.00(OTS).

An optimum economic design for a high temperature, helium cooled, central station reactor power plant of about 400 Mw of electric power was determined. The core consists of a randomly packed bed of unclad graphite spheres, approximately one in. in diameter, impregnated with U^{233} and thorium such that a conversion ratio of near unity is achieved. The high temperature helium permits steam conditions, at the turbine throttle, of 1000°F and 1450 psia. (auth)

11823 CF-57-12-8(Rev.)
Oak Ridge National Lab., Tenn.
CONCEPTUAL DESIGN AND EVALUATION STUDY OF 10,000-kwE AQUEOUS HOMOGENEOUS NUCLEAR POWER PLANT. M. L. Lundin and R. Van Winkle. Dec. 11, 1957. 64p. Contract W-7405-eng-26. $12.30 (ph OTS); $4.50(mf OTS).

A design study and cost estimate were made of a single-region aqueous homogeneous burner nuclear reactor plant and gas-fired superheater-economizer capable of furnishing 10,000 kw of electrical capacity for use on the Wolverine Electric Co-operative system. The plant capital costs for the three sequences considered are as follows:

	One 5-Mwe Turbogenerator	Two 5-Mwe Turbogenerators	One 10-Mwe Turbogenerator
Reactor plant and structures	$ 8,737,990	$ 8,737,990	$ 8,737,990
Economizer superheater	307,290	709,915	505,770
Turbine generator	877,965	1,809,970	1,438,195
	$ 9,923,245	$ 11,257,875	$10,681,955

(auth)

11824 CF-58-4-53
Oak Ridge National Lab., Tenn.
HRT DOME WALL TEMPERATURE. H. C. Claiborne. Apr. 15, 1958. 26p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Maximum HRT dome wall temperatures for reactor powers up to 10 Mw were calculated for both an insulated and uninsulated dome. Temperatures exceeding 315°C in the fuel solution flowing through the HRT dome section can cause phase separation which results in excessive corrosion rates. The results, based on very conservative assumptions, indicated wall temperatures exceeding 315°C could occur in the insulated dome when operating the reactor at 10 Mw. Using the same conservative assumptions, the analysis of the uninsulated dome indicated wall and bellows temperatures below 300°C. (auth)

11825 CF-58-5-78
Oak Ridge National Lab., Tenn.
WALL POWER DENSITY AND NEUTRON ABSORPTIONS IN HRE-3 CORE-INLET PIPE. M. W. Rosenthal. May 27, 1958. 6p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The reduction in HRE-3 breeding ratio resulting from neutron absorptions in the core-inlet line was examined for spherical and cylindrical cores; it was found to be less than 0.5% if the pipe does not extend more than ¼ the way from the top to the bottom of the core. The power density at the end of the pipe would be 57 kw/l if it extended 5 in. into the sphere. (auth)

11826 CF-58-6-42
Oak Ridge National Lab., Tenn.
HRT BLANKET DUMP TANK PRESSURE. N. Hilvety. June 5, 1958. 7p. Contract [W-7405-eng-26]. $1.80 (ph OTS); $1.80(mf OTS).

In changing the dumping program for the HRT, it is possible that the entire contents of the reactor will flow into the blanket dump tanks. This study investigates whether the resulting dump system pressure exceeds the allowable limit. For the case of a dump of the entire contents of the HRT high pressure system, commencing two minutes after shutdown from an operating power of 5 Mw and with an average fuel temperature of 280°C, into the blanket dump tanks, the resulting maximum pressure was calculated to be about 375 psia. This maximum pressure which will occur about six minutes after the start of the dump, is well below the permissible limit of about 500 psia. (auth)

11827 CENC-1001
Combustion Engineering, Inc. Nuclear Components Engineering Dept., Chattanooga.
THERMAL TEST REPORT — PWR TEST VESSEL WITH PLAIN HEMISPHERICAL HEAD. J. S. Hucks and H. K. Williams. May 1957. 102p. For [Westinghouse Electric Corp. Bettis Plant]. CE Contract No. 7954-14. $18.30(ph OTS); $6.00(mf OTS).

Results of the PWR thermal cycling tests pertinent to transient heat flow through various sections of the test vessel with plain hemispherical head are presented. The test data are compared with the calculated results and an analysis made of the assumptions as to boundary conditions and various constants in the transient conduction heat flow problem. The analytical results are found to be in agreement with the test results. (auth)

11828 CENC-1004
Combustion Engineering, Inc. Nuclear Components Engineering Dept., Chattanooga.
STRUCTURAL ANALYSIS REPORT — PWR PRESSURE VESSEL. M. N. Feldman. July 1957. 365p. For Westinghouse Electric Corp. Bettis Plant. CE Contract No. 7954. $61.20(ph OTS); $11.10(mf OTS).

An ASME and Pennsylvania Boiler and Pressure Vessel Code Calculation and a detailed structural analysis of the pressurized water reactor vessel and its components are presented. Pressure vessel code calculations were made to determine size of the vessel wall and other pressure-loaded components to meet the requirements of the code. Additional detailed structural analyses were made to substantiate design details that are not covered specifically by the code. The maximum stresses developed in critical regions and the corresponding loading conditions are presented. (W.L.H.)

11829 CENC-1006
Combustion Engineering, Inc. Nuclear Components Engineering Dept., Chattanooga.
DEVELOPMENT OF SECONDARY SEAL FOR PWR HEAD PENETRATIONS. John Kurek, Jr. and Jennings Simmons. Aug. 1957. 66p. For [Westinghouse Electric Corp. Bettis Plant]. CE Contract Nos. 7954-25 and 7954-30. $12.30(ph OTS); $4.50(mf OTS).

The results of the development program which was initiated to design a seal to back-up the primary seal of the Pressurized Water Reactor are presented. This program was divided into three phases, a packing, a welded membrane, and a metallic gasket. The packing and metallic gasket test are included in this report. (auth)

11830 CENC-1011
Combustion Engineering, Inc. Nuclear Components [Engineering] Dept., Chattanooga.
EXPERIMENTAL TEST REPORT — PWR FULL DIAMETER TEST VESSEL. W. S. Rice and C. W. Lawton. July 1957. Includes Calculation No. S-100-P: BOLT-UP AND PRESSURE STRESSES AT INTERSECTION OF 8" THICK HEAD AND FLANGE. H. F. George. Aug. 8, 1957. 94p. For [Westinghouse Electric Corp. Bettis

Plant]. CE Contract No. 7954-14. $18.30(ph OTS); $6.00(mf OTS).

A description is given of the experimental testing of the PWR vessel and plain hemispherical head for the Westinghouse Electric Corporation including a discussion of the test procedures, instrumentation, problems, and the experimental stress analysis of the vessel and plain head. The head and vessel were subjected to pressure loadings, to pressure cycling for 20,000 cycles and to thermal heat-up and cool-down cycles of 50, 75, and 100°F/hr. (auth)

11831 CRMet-722

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

GRAIN REFINEMENT OF NRX RODS. L. M. Howe. June 1958. 16p.

A study was undertaken to obtain optimum grain refinement in NRX rod slugs, containing 380 ppm carbon, by quenching from the beta phase and annealing for various time intervals in the alpha phase at 650°C If was found that grain refinement may be obtained in slugs which have been rapidly quenched from the beta phase and annealed at 650°C. The amount of grain refinement obtained was not as great as that obtained previously with small uranium samples in which the rate of cooling through the alpha-beta transformation was greater than that for the NRX rod slugs. In order to obtain a refined grain size of 100 microns, cooling rates through the alpha-beta transformation of approximately 1000°C/sec are required. (auth)

11832 FICO-101(Vols. 1 and 2)

Ford Instrument Co., New York.

15 MW GAS COOLED CLOSED-CYCLE REACTOR POWER SYSTEM STUDY. VOLUMES 1 AND 2. Final Report. Apr. 1, 1957. Contract AT(30-3)-215. $5.00 (OTS).

This is to be a thermal, heterogeneous, nitrogen-cooled, graphite-moderated, and 10% enriched UO_2 fueled reactor. The core is a right cylinder with end and side reflectors. The heat input for the power plant is 44 Mw, and the electrical output is 15 Mw. Theoretical studies covering the physics of the processes occurring in the core, the thermodynamics of heat transfer from the fuel elements to the coolant gas, and the thermodynamics of the gas cycle in the system as a whole were studied. Mechanical and engineering design studies were also made of the core materials, structural members, gas cooling equipment, and all other power plant accessories that must meet requirements unique to nuclear reactors. (M.H.R.)

11833 GA-56(Pt. I)

General Atomic Div., General Dynamics Corp., San Diego, Calif.

GAS-COOLED MARINE NUCLEAR POWER PLANT. Interim Report. W. I. Thompson, F. Adler, K. Case, W. H. Bond, E. C. Creutz, E. A. Hale, A. C. McClure, D. Nicoll, L. W. Nordheim, D. F. Putnam, N. Rostoker, G. T. Schnurer, M. T. Simnad, H. P. Sleeper, and G. B. Webb. Jan. 25, 1957. 173p. Project 16. Contract AT(04-3)-118. $3.00(OTS).

Work on the gas-cooled reactor power plant was concentrated on the following items: exploration of neutron flux and fission density in reactor core by multigroup methods, justification of 2-group procedures and selection of constants, comparison of gases for use in reactor cooling and/or power cycle, and preliminary reactor mechanical design. Detailed study was limited to the reactor type described in our proposal to the Maritime Administration, which consists of a gas-cooled, ZrH_n-moderated core surrounded by a graphite reflector. The fuel elements are constructed of a mixture of UO_2 in stainless steel and are clad in stainless steel. In addition to the above items, a start was made on burnout calculations, control theory, prompt and delayed temperature coefficients, and reactor kinetics. The latter is particularly important in studying problems of stability and safety. The possible use of graphite instead of ZrH_n as a moderator was considered. Some tentative conclusions are drawn: The reactor and associated power equipment will compare favorably on a weight-per-horsepower basis with a pressurized-water type of system such as the Submarine Thermal Reactor (STR). The thermal efficiency will be on the order of 34%. The principal safety problem, for which we are now searching for a solution, is the removal of fission-product afterheat in a complete disaster. A liquid-cooled reactor has a distinct advantage because of the possibility of natural-convection cooling. The economical fuel inventory for this system is probably greater than 100 kg of U^{235}. Total costs will probably run somewhat lower than costs for the pressurized-water systems since a larger proportion of the closed-cycle plant's weight is in the shielding material, which is relatively inexpensive. (auth)

11834 HW-56185 A2

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PLUTONIUM RECYCLE PROGRAM MONTHLY REPORT [FOR] MAY 1958. F. W. Albaugh, L. P. Bupp, P. F. Gast, and L. H. McEwen. June 15, 1958. 19p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Progress is reported briefly in development of fuel element materials, instrumentation, and mechanical equipment for the PRPR. (For preceding period see HW-55905-A2.) (W.L.H.)

11835 IDO-2021(Rev. 1, App.)

Kaiser Engineers Div., Henry J. Kaiser Co., Oakland, Calif. and Nuclear Products-Erco Div., ACF Industries, Inc., Washington, D. C.

APPENDIX TO PRELIMINARY DESIGN, 55,000 KW PROTOTYPE NATURAL URANIUM, GAS COOLED, GRAPHITE MODERATED NUCLEAR POWER PLANT (PROTOTYPE FOR AN OPTIMUM PLANT). (Cover carries title: APPENDIX TO GAS COOLED POWER REACTOR, PRELIMINARY DESIGN, 55,000 KW PROTOTYPE NATURAL URANIUM NUCLEAR POWER PLANT). Report No. 58-1-RE. Mar. 1958. Revision 1, Apr. 1, 1958. 136p. Contract AT(10-1)-925. $5.00(OTS).

Outline specifications are given in the following categories: civil; architectural; structural; heating, ventilating, and air conditioning; piping systems and associated equipment; electrical; mechanical; instrumentation; and reactor components. An outline of startup, operation, and maintenance procedure, the preliminary estimate of cost, the construction schedule, and the preliminary reactor safety analysis is included. Data for the comparison of longitudinal, transverse, and helical finned fuel elements are presented. Drawings are given for all phases of the plant included in the outline specifications. (M.H.R.)

11836 IDO-16397

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

KINETIC STUDIES ON THE SPERT I REACTOR. I. INITIAL BEHAVIOR BY THE ENERGY MODEL. G. W. Griffing and L. I. Deverall. Apr. 18, 1958. 34p. Contract AT(10-1)-205. $1.00(OTS).

The results of an extensive set of computations on the initial behavior of the SPERT I reactor are reported. The model used was a refinement of the model first introduced by K. Fuchs and investigated recently by the SPERT staff. The modifications consisted of retaining the delayed neutrons in the reactor kinetics equations and including the possibility for energy to escape from the reactivity compensating mechanism. These refinements give improvements over the original Fuchs' model in bringing out some of the features observed in the SPERT I transients. For instance, apparently the inclusion of the delayed neutrons will explain the characteristic observed features of the plot of maximum power versus the reciprocal period. As a part of the study, parameters appearing in the equations were varied to examine their effects on the power and to give clues for further modification of the model. (auth)

11837 KAPL-M-JS-3
Knolls Atomic Power Lab., Schenectady, N. Y.
VARIATIONAL CALCULATION OF THERMAL-AVERAGE CROSS SECTIONS. John C. Stewart, Norman C. Francis, and Theodore J. Krieger. June 12, 1958. 10p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

Calculated values of thermal utilization in an infinite medium are in general only as accurate as the neutron energy spectrum used to obtain them. A method of variational calculation of spectra (VARICOS) is outlined here which employs an approximate adjoint (neutron importance) function to obtain improved utilization values with small additional effort. (auth)

11838 KAPL-M-WKA-12
Knolls Atomic Power Lab., Schenectady, N. Y.
BASIS FOR PRESENT S3G BURNABLE POISON DESIGN PROPOSALS. W. Kermit Anderson and John H. Germer. July 6, 1956. Decl. Mar. 13, 1957. 16p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40 (mf OTS).

Two types of burnable poison elements for use in the Submarine Advanced Reactor have been proposed. These include a reference element consisting of a 0.19 wt. % B^{10} stainless steel rod clad with 304 stainless tubing. The principle backup will be in a pin-type tube filled with a ceramic dispersion of B_4C in Al_2O_3. As a secondary backup, an element of stainless steel-boron alloy is being studied which includes a bonded clad. Background information on the materials and design factors involved are included. (W.L.H.)

11839 NACA-RM-SE57F28
Lewis Flight Propulsion Lab., Cleveland.
NACA ZERO POWER REACTOR FACILITY HAZARDS SUMMARY. B. Lubarsky and D. J. Connolley, eds. June 24, 1957. 61p.

The NACA Zero Power Reactor is to be a homogeneous reactor using uranyl fluoride (UO_2F_2)–water solutions. The facility is designed for steady-state reactor operation of 10 watts, producing thermal neutron fluxes up to 10^8 neutrons/cm^2sec. One control rod will be installed, a safety rod, and will not be used for regulation. The facility is described including details of the system, the control system, and the reactor physics associated with certain families of loadings. The site is discussed complete with meteorology data and a geology map of the section. The kinds of experiments considered for the reactor, the hazards, including those associated with the maximum credible accident, and the administrative procedures are included. (M.H.R.)

11840 NDA-14-128
Nuclear Development Corp. of America, White Plains, N. Y.
THE BEHAVIOR OF A REACTOR AT PROMPT CRITICAL WHEN THE REACTIVITY IS A LINEAR FUNCTION OF TIME. J. Ernest Wilkins, Jr. June 5, 1956. 28p. For Atomic Power Development Associates, Inc. $4.80 (ph OTS); $2.70(mf OTS).

Simple analytic formulas are derived for the values of the prompt neutron density, the delayed neutron emitter densities, and the period in a reactor at the instant it has become prompt critical under the assumption that it has been brought to a prompt critical state from an initially critical state by introducing reactivity at the constant rate of a dollar per second. For a fixed value of a, these formulas are asymptotic with respect to small values of the dimensionless parameter al/β, in which l is the mean lifetime of a neutron in the reactor and β is the fraction of fission neutrons which are delayed. For fast reactors, the quantity $1/\beta$ is generally small, so that the formulas should be useful in estimating the power rise at prompt critical unless the rate of introduction of reactivity is quite large. (auth)

11841 NDA-84-7
Nuclear Development Corp. of America, White Plains, N. Y.
SDR PROJECT QUARTERLY TECHNICAL PROGRESS REPORT FOR THE PERIOD FEBRUARY 1, 1958 THROUGH APRIL 30, 1958. E. Bernsohn. June 30, 1958. 56p. Contract AT(30-3)-256. $9.30(ph OTS); $3.60(mf OTS).

Work continued during the quarter on the preliminary design and experimental study of the calandria–through-tube type of reactor. The major achievement has been the successful completion of most of the experimental program. The barrier testing program is completed. The portion remaining to be done on the fuel-coolant tube and header test program amounts to only a few percent of the total experimental program for Phase I of the SDR project. The mockup apparatus will continue running until the end of the contract period, but on the basis of experience gained thus far its operation is expected to be routine. Assembly work was completed on the apparatus for the fuel-coolant tube and header tests and about 80% of the planned test program was completed. At 1050°F and under cyclic loadings greater than those anticipated in the reactor, it appears, from the results obtained to date, that the tube and header design is capable of withstanding over 10,000 cycles without failure (10,000 cycles corresponds to one shutdown per day for 30 years). The Phase I barrier test program planned for execution in the multiple-failure apparatus was completed. Included in this series of tests were simulated water or sodium leaks on a double barrier, on a fuel-coolant tube, and on a calandria tube. Simultaneous sodium and water leaks on a double and on a single barrier were simulated. In all tests there was no perforation at the point of impingement of the sodium and water jets. The only noticeable effect was a slight distortion of the single aluminum barrier tube when subjected to simultaneous jets of sodium and water. Inadvertent sodium-water reactions occurred in and around the barrier spaces when drainage lines plugged during certain tests; there were no deleterious effects. The conclusions drawn from this program are that the double barrier is more than adequate, that the single barrier is feasible, and that sodium-water reactions occurring in an apparatus simulating the reactor can be handled without difficulty. At the time of writing this report, the

mockup apparatus has successfully completed one 360-hr run and is half way through a second such run, demonstrating that this mockup of the calandria-through-tube design is capable of circulating sodium and water reliably under simulated reactor temperature conditions over long periods of time. Design work on the reactor has extended previous studies on coolant tube and header arrangement, heat transfer, fuel element design, barrier design, and calandria fabrication. The serious consideration now being given to UO_2 fuel elements is of special interest. The comparatively advanced state of development of the UO_2 fuel element is a cogent argument in favor of its selection. Also a significant factor is the similarity of SDR requirements to those of the SGR, suggesting that fuel element development work would be considerably less than that required for U-Mo elements. Because of the low conductivity of UO_2 and reduced volume fraction of uranium in UO_2, the number of lattice positions might have to be increased. Consideration is being given to reduced lattice spacing in order to hold calandria size constant. Also, consideration is being given to the possibility of replacing the D_2O side reflector with a graphite or water reflector outside the calandria. While design continued on the two-barrier arrangement initiated in the previous quarter, attention was also given to comparing one-barrier and two-barrier designs. In view of improved design simplicity and savings in cost and reactivity losses, it appears desirable to remove the stainless steel barrier and leave only the aluminum one. Removing one barrier increases the heat transfer to the moderator, an effect which is now being evaluated analytically, but it is expected that the single barrier will be sufficient from a heat transfer standpoint. Preliminary design studies have been performed on a number of systems, namely the D_2O cover gas system, thermal shield coolant system, barrier gas systems, and the D_2O system. Layout studies of the containment building have progressed through a first round. Considerable refinement of these layout studies is in process, and it is anticipated that the volume requirement within the building will be appreciably reduced. At the same time calculations are underway to determine containment building volume needed to withstand pressure buildup in the event of an accident that may induce a sodium-water reaction. Detailed core physics calculations were made for the reactor design based on U-Mo fuel elements to determine the enrichment required to reach a burnup of 5000 Mw-d/ton. The enrichment required is 1.75%. Shielding work has included calculations of gamma heating of the barrier tubes and calandria tubes, determination of photoneutron production rate in the D_2O, and design of the thermal shield. A number of studies pertaining to heat transfer and sodium flow in the core were continued. Included were determination of pressure drop in the core, establishment of a safe limit on length of fuel-coolant tubes projecting above the D_2O surface in the calandria, and study of transient behavior at different points following a reactor scram. The most recent heat transfer studies indicate that the number of lattice positions for the UO_2-fueled design may be made comparable to the number in the U-10 weight % Mo design by employing a 19-rod cluster rather than the 7-rod SRE-type cluster originally considered; if this tentative conclusion is verified by further study, it will not be necessary to reduce lattice spacing or use an external reflector to maintain practical calandria tank dimensions. Procedures to be followed in the event of a major leak in the primary sodium system have been considered, and analytical studies of emergency gas cooling of fuel tubes have been initiated. A study of a natural uranium SDR was begun, with emphasis thus far on the economic promise of the SDR type. (For preceding period see NDA-2084-5.) (auth)

11842 NP-6748

Cornell Univ., Ithaca, N. Y.

THE CORNELL UNIVERSITY DUAL-CORE REACTOR. Preliminary Design. Jan. 1958. Appendix I. CALCULATIONS FOR THE SWIMMING POOL CORE. Appendix II. CALCULATIONS FOR THE ZERO POWER CORE. 71p.

A dual-core reactor facility for a nuclear training program is proposed having an intermediate power "swimming pool" core, and a "zero power" quasi-flexible critical studies core. The 10-kw "swimming pool" core resembles the NRL Research Reactor in that the core will be rigidly fixed in a graphite niche, surrounded on three vertical faces of graphite and on the fourth by a pool of light water. The fuel elements will be the Materials Testing Reactor Al-U type. The "zero power" core will consist of 1 to 2 tons of 1.5% enriched U in Al-clad rods which can be arranged in various lattices by means of movable grid plates. The primary detectors, i.e., the fission chambers and ion chambers in each core, will feed their outputs to individual mating boards. A common bank of amplifying, recording, and safety equipment will be connected to a mating board which is interchangeable for the two cores. A gamma irradiation facility is included as an auxiliary to the reactor. (M.H.R.)

11843 NP-6777

Westinghouse Electric Corp. Research Labs., East Pittsburgh, Penna.

SOLUTION TO MULTI-GROUP DIFFUSION EQUATION FOR PLANE GEOMETRIES. Scientific Paper 6-94469-3-P1. R. S. Carter. Nov. 25, 1957. 24p.

A solution was obtained for the one-dimensional multi-group neutron diffusion equation in integral form. The integral expression was then reduced to a form suitable for hand calculation. The relationships developed between the expressions for the fluxes in the several groups greatly simplified the calculation and permitted the numerical results to be obtained in a reasonably short time. The flux distributions for neutrons with energy greater than a kilovolt in an H_2O and D_2O reflector were calculated by this method using nine groups. The results are presented. (auth)

11844 NP-6787

MSA Research Corp., Callery, Penna.

PROGRESS REPORT NO. 46 FOR APRIL AND MAY 1958. W. J. Posey, ed. June 16, 1958. 30p. Contract NObs-65426.

The response characteristics of three chromel-alumel thermocouples to a ramp function change in temperature in the Bettis Foster Flow tube with the Core I seed cluster were determined. Experiments to obtain information on film boiling at elevated pressures in a forced-convection system were performed. The water parameters covered were: water inlet temperature 500 and 600°F, pressure 2000 psig, and mass flow rates 0.4×10^6 to 1.5×10^6 lb/hr-sq ft. Stress corrosion cracking of 304 stainless steel pipe by exposure to chloride-bearing water is being investigated. Fission product release and zirconium-water explosion hazards in core meltdown were evaluated by melting two zirconium-uranium subassemblies in a steam atmosphere. (For preceding period see NP-6661.) (W.D.M.)

11845 NYO-8504
Ford Instrument Co., Long Island City, New York.
DIGITAL PRESSURE INDICATOR SYSTEM. Jan. 17, 1958. 30p. Contract AT(30-1)-1969. $4.80(ph OTS); $2.70(mf OTS).

The primary objective of this study is to investigate an improved pressure indicator system which provides digital inputs to a digital type of reactor control system. A practical means of converting pressure to digital form is described, based upon the conversion of pressure to a frequency-varying voltage and the conversion of this voltage to binary pulses. It is concluded that this system is feasible and advantageous. It is further concluded that these digital techniques provide a higher order of reliability, accuracy, and stability than equivalent analog systems. (auth)

11846 ORNL-2484
Oak Ridge National Lab., Tenn.
BOUNDARY VALUES FOR THE INNER RADIUS OF A CYLINDRICAL ANNULAR REACTOR. E. L. Zimmerman. June 25, 1958. 25p. Contract W-7405-eng-26. $0.75(OTS).

A boundary condition applicable to the inner radius of cylindrical annular reactors of finite length is derived. The resulting boundary condition is given as the ratio of the flux to the radial derivative of the flux at the inside radius and is expressed as a function of the geometry and the neutron mean free path in the multiplying material. The method assumes the validity of diffusion theory and also that the flux is separable into radial and axial parts. While the result is applicable to the more general multigroup calculation, a two-group treatment is presented by way of illustration. The latter is of practical value for such cases in which adequate two-group constants are available either from fundamental cross-section data or from a comparison to critical experiments using similar materials. (auth)

11847 SO-6200
Little (Arthur D.) Inc., Cambridge, Mass.
HAZARDS AND SAFETY MEASURES FOR NUCLEAR-POWERED MERCHANT SHIPS: AN ANNOTATED BIBLIOGRAPHY. Sept. 15, 1957. 278p. Contract AT(30-3)-288. (ALI-C-60808). $4.00(OTS).

Over 600 references and abstracts from the open literature on nuclear science and related subjects are presented. The abstracts have not been cross-referenced. They have been arranged by subject matter so that ready reference is provided by means of the Table of Contents. Indices relating each abstract to its subject, author, and previous publication number are also provided. The bibliography covers literature from mid-1940 through June 30, 1957. (auth)

11848 WAPD-A1W(PF)-398
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
SIZING CRITERIA FOR THE A1W PRESSURIZER. T. Ramoino. Oct. 31, 1955. 22p. $4.80(ph OTS); $2.70(mf OTS).

The sizing criteria to be used for estimating the volume of the A1W pressurizer are described. An estimate of a tank size which is compatible with operational and space requirements is included. (W.L.H.)

11849 WAPD-CTA-EL-1004
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
PWR SIMULATOR STUDIES. SERIES III. Zachary H. Calhoun. 1955. Decl. Dec. 17, 1956. 131p. Contract [AT-11-1-GEN-14]. $21.30(ph OTS); $6.90(mf OTS).

Data resulting from an investigation of PWR plant performance following various steam flow and reactivity changes are presented. The data were obtained to assist in pressurizer design by giving the transient variation in primary pressure following steam flow disturbances. Data were also obtained to assist in control system design by presenting the transient response of various control systems to steam flow changes and approximate Xe transients. The plant simulation is discussed, and the results are given. (W.L.H.)

11850 WAPD-NCE-5215
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PWR CORE I CORE ASSEMBLY ENGINEERING TOOL OPERATIONAL MANUAL. M. E. Stairs, J. M. Campbell, and W. J. Hurford. July 1, 1957. 88p. Contract AT-11-1-GEN-14. $13.80(ph OTS); $4.80(mf OTS).

The manual describes the design and operation of tools used by the core Assembly Engineering Group for assembly of the PWR core. (W.L.H.)

11851 WAPD-NCM-PL-51
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SHIPPINGPORT PWR CORE I FUEL COMPONENT FABRICATION PROCESS AND EQUIPMENT MANUAL. R. F. Cobb and D. A. Wigton, comps. and eds. Jan. 1958. 48p. Contract AT-11-1-GEN-14. $7.80(ph OTS); $3.30 (mf OTS).

A brief, logical sequence of fabrication operations, equipment, and equipment cost for Shippingport PWR core 1 fuel component fabrication is presented. (W.L.H.)

11852 WAPD-P-659
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
IRRADIATION OF PLASTIC FUEL TAPES. PART III. P. A. Nicoll and E. R. Sanford. July 1955. Decl. May 5, 1958. 33p. $6.30(ph OTS); $3.00(mf OTS).

The study of the expansion characteristics of polyethylene fuel tape subjected to neutron irradiation was continued. The present series of tests show that unclad polyethylene tape, 46.4 wt. % U_3O_8, expands less under 100 psig helium than at atmospheric pressure. The general behavior is similar under both conditions. Polyethylene tape (50 wt. % U_3O_8) clad with polyethylene shows expansion characteristics at atmospheric pressure very similar to those of the unclad 46.4 wt. % U_3O_8 tape at that pressure. The behavior of polyethylene tape (50 wt. % U_3O_8) clad with mylar differs somewhat from that of the unclad tape, although expansion does occur and is reduced by "aging" previous to irradiation. Gold foil flux monitor data give a cadmium ratio in BNL PN-4 of 3.70 and thermal neutron fluxes of 1.91×10^{12} neutrons/cm^2-sec in PN-4 and 4.2×10^9 neutrons/cm^2-sec in the Instrument Hole. (auth)

11853 WAPD-PC-234
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
PWR REACTOR PLANT MAIN CONTROL CONSOLE FUNCTIONAL ARRANGEMENT. [nd]. 4p. $1.80 (ph OTS); $1.80(mf OTS).

The functional arrangement of the PWR Main Control Board is given. It is a desk-type console with sloping desk section and near vertical instrument section. The console will be adjacent to and attached to the steam turbine section of the station control center, which in turn is joined to the main generator and associated electrical control center. (W.L.H.)

11854 WAPD-PWR-CP-1974
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
THE USE OF ZIRCALOY-2 FOR IN-PILE TUBES.

R. M. Lieberman. [Mar. 1956.] Decl. Apr. 3, 1957. 11p. $3.30(ph OTS); $2.40(mf OTS).

A preliminary study of the use of Zircaloy-2 for in-pile tubes indicates the following: Significant increases in test flux can be achieved in low flux reactor such as NRX. Tentative design properties for Zircaloy-2 allow the use of practical test section sizes. The major problems are: confirmation of properties, the development of manufacturing techniques, and the development of Zircaloy-2–stainless transition joints or closures. The program required to meet these problems and provide a Zircaloy in-pile tube for the next NRX central thimble test is presented. The costs are estimated at $117,000. (M.H.R.)

11855 WAPD-PWR-CP-2130
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
RECOMMENDATION OF POISON SUBSTANCE FOR EMERGENCY CHEMICAL SHUTDOWN OF PWR. Paul Cohen. May 24, 1956. 4p. $1.80(ph OTS); $1.80 (mf OTS).

After listing criteria for the poison substance abstracted from other references, boric acid was recommended for PWR emergency shutdown as the cheapest, simplest, most convenient, and most thoroughly evaluated material available. (M.H.R.)

11856 WAPD-PWR-CP-2457
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
NEED FOR A CATION EXCHANGE COLUMN UPSTREAM OF A DELAYED NEUTRON MONITOR IN PWR. P. W. Frank. [Sept. 1956]. 2p. $1.80(ph OTS); $1.80(mf OTS).

The gamma radiation field expected at the center of a conceptual PWR delayed neutron monitor of one gallon volume is calculated. A delayed neutron monitor as a fuel element failure location system in the PWR would, in order to have sufficient sensitivity, have to use BF_3 counting tubes. Boron trifluoride tubes are sensitive to gamma radiation and in a sufficiently high field the neutron activity would be masked by spurious gamma counts. In the absence of a large number of normal defects, the gamma field in the monitor would be mainly due to induced activities in the coolant. Since induced activities are largely cations the gamma field in the monitor could be reduced by inserting a cation exchange column upstream of the monitor. (W.L.H.)

11857 WAPD-PWR-CP-3025
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
PROPOSED DESIGN AND MATERIALS EVALUATION PROGRAM FOR ETR 6" × 6" LATTICE FACILITY IN PILE TUBES. S. A. Weber, W. Schwartz, and P. Cohen. [1957?]. 4p. $1.80(ph OTS); $1.80(mf OTS).

The Engineering Test Reactor will have a considerably higher gamma heating level than the MTR or other reactors in which irradiation testing has been done. The thermal stresses which would result in in-pile tubes in the ETR can not be dealt with by conventional design methods. To meet this situation a proposed design and materials evaluation program for ETR in-pile tubes is presented. (W.L.H.)

11858 WAPD-PWR-PA-350
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
PWR PRESSURE REGULATING AND RELIEF APPARATUS AND THEIR RESPONSE TO VARIOUS PLANT TRANSIENTS. P. A. Bickel. Dec. 1, 1955. 17p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40 (mf OTS).

The components of the PWR pressure regulating and relief apparatus that are discussed are: pressurizer; pressurizer spray apparatus; pressurizer heaters; pilot-operated pressurizer safety valve; self-actuated pressurizer safety valves; self-actuated reactor relief valves; self-actuated loop relief valves; shut-off valves; purification loop self-actuated relief valves; steam generator safety valves; decay heat removal relief valves; and controlled steam relief valves. (W.L.H.)

11859 WAPD-PWR-PC-748
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
REPORT ON THE PWR CONTROLLER TESTS AT THE NAVAL REACTOR FACILITY. N. E. Wilson. Dec. 6, 1956. 7p. $1.80(ph OTS); $1.80(mf OTS).

Tests on the breadboard of the Power and Temperature Controller demonstrated its ability to control the S1W plant to ± 3°F in the steady state. (auth)

11860 WAPD-PWR-PC-1338
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PWR SIMULATOR STUDIES [FOR] JANUARY–MARCH, 1958. E. A. Wieczorkowski. 129p. Contract AT-11-1-GEN-14. $19.80(ph OTS); $6.30(mf OTS).

The results of analog computer studies of the PWR Primary Plant are presented. These transient studies were made to obtain expected results for several of the tests which will be run on the Shippingport Reactor Power Plant. The computer transients included are: design load swings; controlled steam relief system performance; control rod withdrawal transients; and start-up transients. A brief description of the plant operating condition and scope for each of the four types of transients is given. A complete list of figures of simulator recording is included. (W.L.H.)

11861 WAPD-PWR-PC-1345
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
OPTIMIZATION OF POWER AND TEMPERATURE CONTROL SYSTEM SETTINGS. E. A. Wieczorkowski. [June 1958]. 15p. Contract [AT-11-1-GEN-14]. $3.30 (ph OTS); $2.40(mf OTS).

An analysis based on simulator studies of the PWR power and temperature control system setting was performed to determine the optimum settings which would effect satisfactory control of plant temperatures. The analysis also investigated the feasibility of narrowing the deadband so as to maintain tighter temperature control during Xe buildup and burnout. (W.L.H.)

11862 WAPD-PWR-PCR-172
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
PROPOSAL FOR PWR TRAINING SIMULATOR. [June 1956]. 8p. Contract [AT-11-1-GEN-14]. $1.80(ph OTS); $1.80(mf OTS).

A detailed outline is presented for the proposed method for designing and constructing the reactor simulator. The function, form, method of simulation, the list of simulator operations and transients, description and list of equipment, and cost factors are included. (M.H.R.)

11863 WAPD-PWR-PCR-450
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
COLD WATER ACCIDENT. [1957]. 7p. $1.80(ph OTS); $1.80(mf OTS).

The two ways in which a cold water accident could occur under the existing control scheme for the PWR

are described. A review of the presently provided interlocks and equipment and of the operational procedures is presented. (W.L.H.)

11864 WAPD-PWR-PCR-482
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
REPORT ON TESTS OF MULTIPORT VALVE CONTROL SYSTEM. Cecil T. Wint. Aug. 23, 1957. 9p. $1.80(ph OTS); $1.80(mf OTS).

A magnetic bar or slug is placed across the middle and one outer leg of an E-Core differential transformer. Twelve magnetic slugs are attached to the periphery of a rotor at 30° intervals. This rotor revolves on the same shaft as the port selector of the multiport valve. Each of these twelve rotating slugs crosses the middle and the other outer leg of the transformer in a position symmetrical to that of the fixed slug. Hence there is a balanced flux system every 30°. The resulting output of the transformer secondaries, connected in series opposition, is therefore a series of pulses, one every 30°. Each pulse fires two mag-amps, each of which operates a relay. One relay controls the "stop" circuit of the multiport-valve drive-motor; the other relay energizes a timer which restarts the valve drive-motor after a suitable interval of time. The coolant sampling tubes terminate at 30° intervals in the multiport valve, hence it is possible to use the 30° pulses to control the port selector in the required manner. (auth)

11865 WAPD-PWR-PCR-849
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
TEMPORARY SAFETY AND MONITORING CIRCUITRY FOR INITIAL FILL. [Sept. 1957]. 9p. $1.80(ph OTS); $1.80(mf OTS).

The temporary safety and monitoring circuitry required for initial fill of the reactor is described. All temporary circuitry described will either be removed or modified at the completion of the initial fill. (W.L.H.)

11866 WAPD-PWR-PMA-1492
Westinghouse Electric Corp. Bettis Atomic Power Div., Pittsburgh.
PRODUCTION TEST DATA; SELF-ACTUATED LOOP RELIEF VALVES. M. L. Sloman. Nov. 27, 1957. 5p. PWR Project. Contract AT-11-1-GEN-14. $1.80 (ph OTS); $1.80(mf OTS).

Test data are given for eight self-actuated relief valves. The tests were conducted at the Mishawaka Test Loop. Results of the tests indicate that the eight valves tested and installed in the plant can be expected to perform their intended function in a satisfactory manner. (W.L.H.)

11867 WAPD-PWR-PMA-1504
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PRODUCTION TEST DATA; SELF-ACTUATED REACTOR VESSEL RELIEF VALVES. M. L. Sloman. Dec. 19, 1957. 4p. PWR Project. Contract AT-11-1-GEN-14. $1.80(ph OTS); $1.80(mf OTS).

Production test data are presented for five self-actuated reactor relief valves. Four of these valves are installed in the pressurizer and pressure relief system. (W.L.H.)

11868 WAPD-PWR-PMA-1536
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SELF-ACTUATED PRESSURIZER SAFETY VALVE; PRESSURIZER AND PRESSURE RELIEF SYSTEM. M. L. Sloman. Mar. 6, 1958. 6p. PWR Project. Contract AT-11-1-GEN-14. $1.80(ph OTS); $1.80 (mf OTS).

A portion of the test data for two self-actuated pressurizer relief valves is presented. Test results indicate that the two valves tested will perform satisfactorily with the exception of seat leakage. (W.L.H.)

11869 WAPD-PWR-PMF-789
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
REPAIR OF AN 18" HYDRAULICALLY-OPERATED COOLANT LOOP STOP-VALVE WHILE IN PLACE. J. R. LaPointe. June 20, 1957. 8p. Contract AT-11-1-GEN-14. $1.80(ph OTS); $1.80(mf OTS).

The results of a study to determine a means of repairing an 18 in. hydraulically operated coolant loop stop valve while in place following a period of reactor plant operation are presented. A brief description is given of several methods for accomplishing this, listing the advantages, disadvantages, and possible limitations for each. (M.H.R.)

11870 WAPD-PWR-PMF-868
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
ADDITIONAL CONSIDERATIONS ON THE USE OF LITHIUM HYDROXIDE IN PWR. J. C. Rengel. Aug. 29, 1957. 8p. $1.80(ph OTS); $1.80(mf OTS).

Lithium hydroxide was recommended as the reference condition for the PWR coolant. An investigation of the possibility of caustic stress-corrosion cracking arising from the use of LiOH is presented. (W.L.H.)

11871 WAPD-PWR-PMF-1184
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
TRITIATED REACTOR COOLANT LEAKAGE TO THE REACTOR PLANT CONTAINER. J. R. LaPointe. May 9, 1958. 3p. PWR Project. Contract AT-11-1-GEN-14. $1.80(ph OTS); $1.80(mf OTS).

A plot of the maximum permissible leak rate of tritiated reactor coolant to the reactor plant container atmosphere as a function of the tritium activity in the coolant is presented. (W.L.H.)

11872 WAPD-PWR-RD-606
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
EVALUATION OF THERMAL PERFORMANCE OF PWR CORE 1 DURING POWER OPERATION. N. J. Palladino. May 9, 1958. 10p. $1.80(ph OTS); $1.80 (mf OTS).

An analysis of PWR Core 1 instrumentation data obtained during early operations of the plant is given. The results indicate that the actual thermal performance of the core is in close agreement with design analyses. The design power sharing between seed and blanket was determined from a one-dimensional flux distribution while power sharing within the blanket and within the seed was predicted from two-dimensional flux distributions. (A.C.)

11873 WAPD-PWR-RD1-75
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
EVALUATION OF THE PWR CORE INSTRUMENTATION. S. Cerni and M. McKeehan. [May 1957]. 7p. $1.80(ph OTS); $1.80(mf OTS).

As the PWR is the first "seed type" core power reactor, and as one of its objectives is to provide knowledge on the technical feasibility and operability of such cores, extensive core instrumentation has been provided. The prime purpose of the core instrumentation is to provide information to permit safe effective operation of the plant at all times. In addition, it is desirable to use the instrumentation to determine the maximum power capabilities of the core and to experimentally verify thermal, hydraulic, and nuclear design calculations. This report discusses the adequacy of the core instrumentation in obtaining the desired objectives. (auth)

11874 WAPD-RD-43

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

PWR PRESSURE VESSEL (FLANGE MATERIAL). N. J. Palladino. May 23, 1955 and MINUTES OF MEETING, CE [(COMBUSTION ENGINEERING, INC.)] AND WAPD, HELD AT BETTIS, MAY 19, 1955. (WAPD-RDm-109). 7p., 4 illus. Contract AT-11-1-GEN-14. $6.30(ph OTS); $3.00(mf OTS).

The same material used in the PWR pressure vessel walls was selected for the pressure vessel flanges because of similar chemistry, less difficulty in securing Code approval, impact strength not critical, and no additional welding procedures are needed. Drawings of the flange are included. (T.R.H.)

11875 WAPD-STR-L-192

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

PWR (EASE) PRELIMINARY STUDIES. [Mar. 1955]. Decl. June 13, 1958. 67p. $10.80(ph OTS); $3.90(mf OTS).

The EASE simulation has developed for the initial studies on the inherent plant stability, on the behavior of the plant in response to load and control transients, and on the effectiveness of the proposed control systems. The pertinent data obtained in these preliminary studies are presented. (W.D.M.)

11876 WAPD-T-583

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

NUCLEAR CHARACTERISTICS OF THERMAL POWER REACTORS. I. SEED–BLANKET CORE CONCEPT. O. J. Woodruff, Jr., M. J. Galper, and R. T. Bayard. [1957?]. 38p. $6.30(ph OTS); $3.00(mf OTS).

The generalized objectives guiding the design of a power reactor are discussed relative to the light water cooled and moderated thermal reactor using a high uranium content fuel element. A survey of reactor concepts directed toward these objectives is presented and the seed–blanket core concept in which a highly enriched uranium region (the seed) is used to drive a surrounding natural uranium region (the blanket) is discussed in detail. The variation of design parameters for the seed–blanket core type is discussed and calculational data presented to evaluate possible choices in the design. Performance characteristics such as fuel loading, nuclear fuel utilization, control rod requirements, power distribution, and nuclear factors affecting thermal performance of the core are discussed. Calculational data are presented to illustrate the variation of these factors with the choice of design parameters. (auth)

11877 WAPD-TM-119

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

TWO REGION STUDIES IN SLIGHTLY ENRICHED WATER MODERATED URANIUM AND URANIUM DIOXIDE LATTICES. J. J. Volpe and G. G. Smith. Mar. 1958. 33p. Contract AT-11-1-GEN-14. $1.00 (OTS).

A study of the flux distributions of two region core configurations was made for the TRX facility. The purpose of this study was to obtain an estimate of the size of a critical configuration that would yield the same values of the basic reactor parameters in the inner region as a critical core consisting entirely of the inner region material and geometry. The TRX is a heterogeneous, light water moderated and reflected reactor. The fuel is in the shape of cylindrical rods cladded with aluminum and arranged in a hexagonal pattern in a stainless steel lattice plate. The total length of the fuel is 48 in. The outer boundary of the fuel region is arranged to approximate a cylinder. The core configuration studied is shown. The spacing of the fuel rods yielded a water to equivalent uranium volume ratio of 5 to 1. This particular two region core employs the use of one lattice plate. The number of hexagons and fuel rods enclosed by various inner region sizes are listed. The flux distributions were investigated using a one-dimensional few group equation code. Four neutron energy groups were used. Fast group constants were calculated using zirconium cross section values in place of the aluminum present due to an incomplete knowledge of the aluminum cross sections. An appropriate correction factor is applied for this substitution. No substitution is made for the aluminum in the calculation of the slow group constants. The investigations presented may be divided into two parts. The first is a discussion of the two region configuration in which the inner region radius is varied. The second is a discussion of the configuration in which a water gap has been included between the inner and outer regions. Various combinations of inner region radii and water gap sizes were studied. (auth)

11878 YAEC-31

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

YANKEE CRITICAL EXPERIMENTS. Hazards Summary Report. W. H. Arnold, Jr., S. S. Berg, P. W. Davison, A. B. de St. Maurice, R. D. Edsell, R. P. Goldstein, H. W. Graves, Jr., and D. Hunter. May 31, 1957. Addendum 1. W. H. Arnold, Jr., S. S. Berg, W. H. Bergmann, P. W. Davison, H. W. Graves, Jr., and D. Hunter. Aug. 1, 1957. Addendum 2. P. W. Davison. Aug. 16, 1957. 166p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, [Sub]contract No. 1. $24.30(ph OTS); $7.50(mf OTS).

The Yankee critical experiments will be conducted at the Westinghouse Reactor Evaluation Center. This building was designed to minimize the dangers due to fire, windstorm, or flood and is located in a sparsely populated region. Several conceivable accidents are analyzed. A calculation which assumes the most adverse meteorological conditions for the most serious accident has shown that the immersion gamma-ray dose received at the nearest site boundary would be 11.4 rem. At the nearest community this dose would drop to 6 rem. (M.H.R.)

11879 YAEC-46

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

NUCLEAR CHARACTERISTICS OF MULTIREGION-LOADED REACTOR CORES. George H. Minton. Jan. 1957. 54p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $9.30(ph OTS); $3.60(mf OTS).

Multiregion cylindrical reactor cores are studied in which new fuel is loaded into only one annular region with the other regions being occupied by fuel in different stages of burnup. Fuel utilization, power distribution, and control requirements are determined for a model in which the region-averaged thermal fluxes are used to determine the fuel characteristics as a function of time. Results are compared with those obtained for reactor cores which are loaded uniformly and burn out at a rate determined by the region averaged fluxes. (auth)

11880

THE LESSONS OF THE WINDSCALE ACCIDENT. G. Wiesenack. Atomwirtschaft 3, 183-8(1958) May. (In German)

If suitable atomic scientists and technicians are in short supply in a certain country, the reactor operating departments are more likely to suffer than the research and development institutes. This is one of the lessons taught by the Windscale reactor accident. Also of importance for future development in Germany and other countries are lessons from the technical and organizing point of view: the significance of drafting detailed operating instructions and their continuous control and improvement, preparatory measurements in the vicinity of a reactor plant to allow quick measures in case of an accident, and the stipulation of practical maximum permissible radiation doses. (auth)

11881

PROTECTION AGAINST THE ECONOMIC CONSEQUENCES OF REACTOR ACCIDENTS: DEVELOPMENT IN THE FEDERAL REPUBLIC. M. Scheidwimmer. Atomwirtschaft 3, 192-5(1958) May. (In German)

Protection against the economic consequences of a reactor accident must include those effects which will affect the owner of the reactor itself and his suppliers by the damage to the reactor and also those which will arise from third party liability born by owner and supplier. In the Federal Republic liability in accordance with Civil Law, the proposed Atomic Law, trade inspection regulations, and the water economy law must be considered. Insurance, aggregate liability by the Federal Government, and the exclusion of certain farther reaching claims will serve as a certain protection. Against some of the risks, such as damage caused by serious negligence of the insured party, certain losses for damage to property belonging to the insured, and losses arising from continuous effects, only partial protection will be available. (auth)

11882

ON THE RATE OF CONVERGENCE OF THE SPHERICAL-HARMONICS METHOD FOR A SANDWICH REACTOR OF SMALL LATTICE PITCH. B. Davison (Univ. of Toronto, Can.). Can. J. Phys. 36, 784-800(1958) June.

There are some cases where the spherical-harmonics-method calculations can be carried out purely algebraically, without specifying numerically the order of approximation used. Such is the problem of determining the spatial distribution of the thermal neutron flux in an infinite sandwich reactor of a small lattice pitch The spherical-harmonics-method solution of this problem, in an arbitrary order of approximation, is compared with the exact solution. It is shown that if both are expanded in the Fourier series in terms of the optical depth, the nth term of the Fourier series for the spherical-harmonics-method solution differs from the corresponding term for the exact solution by the factor $[\tanh(N\epsilon/n\pi) + 0(\epsilon)]$, where N is the order of approximation used in the spherical-harmonics-method and ϵ is one-half of the lattice pitch on the optical scale. (auth)

11883

THE CANADIAN REACTOR NRU. L. Roseo. Energia nucleare (Milan) 5, 361-82(1958) June. (In Italian)

The NRU reactor became critical, for the first time, in November 1957. It is a high flux, natural uranium fueled, heavy water moderated and cooled material testing reactor. Its thermal power is 200 Mw. This paper describes briefly the NRU plant pointing out some of the most outstanding features which are embodied in its design. (auth)

11884

A SYNTHETIC METHOD TO ESTIMATE THE TOTAL REACTIVITY ABSORBED BY THE CONTROL SYSTEM OF LARGE POWER REACTORS. G. Vacchelli (Sorin, Milan). Energia nucleare (Milan) 5, 393-7 (1958) June. (In Italian)

Calculations of the reactivity absorbed by control rods in a thermal reactor are generally made with analytical methods, at first evaluating the reactivity absorbed by a central rod and then the eccentricity effect and finally summing the effects, in some way accounting for mutual shielding. It is interesting to note that this problem may be more synthetically stated when larger heterogeneous power reactors are concerned, as their control rods are in most cases uniformly distributed inside the reactor core. In this event the reactor may be considered as formed by elementary cells each one consisting of a central absorbing element surrounded by a core portion. From these premises it is easy to draw a more synthetic formulation of the reactivity absorbed by the control system, generalizing the well known notions of thermal utilization and resonance transparency factor. (auth)

11885

PROSERPINE, FRENCH PLUTONIUM REACTOR. J. Bertrand, P. Lecoustey, and J. Tachon. Ind. Atom. 2, No. 5-6, 110-18(1958). (In French)

Proserpine, a homogeneous, thermal reactor using Pu fuel is described along with the building housing the reactor and associated research facilities. The core, fuel circulation system, control system, reflector, safety devices and a criticality study program are discussed. (T.R.H.)

11886

CONTROL SYSTEM OF REACTORS BR 1 C.E.A.N., MOL, BELGIUM. Charles Gerard and Jean Lhoir (Centre d'études de l'énergie nucléaire, Mol, Belgium). Ind. Atom. 2, No. 5-6, 123-32(1958). (In French)

The control system of the BR-1 reactor, including measurement probes, safety devices, ruptured slug detectors, instruments, and control panel, is described and discussed. (T.R.H.)

11887

THE NUCLEAR PROPULSION NO. OF SHIPS. Christopher Hinton and R. V. Moore (United Kingdom Atomic Energy Authority). J. Joint Panel Nuclear Marine Propulsion 2, 1-25(1958) Apr.

After briefly reviewing the historical background of power driven ships and inferring some analogous future trends, the characteristics of pressurized water and gas cooled, graphite moderated reactors are reviewed in general terms. A gas cooled, graphite moderated reactor of high rating designed for the propulsion of a supertanker is described. The economics of operation of a nuclear powered supertanker is compared with one which is conventionally powered. Some of the practical problems, including control and safety, of a nuclear powered ship are defined and discussed. A review of some reactor types having potential merit for the marine application is included. While nuclear power units of 20,000 to 25,000 shp with competitive economic performance could be designed in the next few years, a reactor suitable for powers below these values has yet to be developed. (auth)

11888

CONTROL OF NUCLEAR REACTORS. L. W. J. Newman (H. M. Hobson, Ltd., Wolverhampton, Eng.). J. Joint Panel Nuclear Marine Propulsion No. 2, 21-3 (1957) Oct.

The problems encountered in reactor control and how their solution is accomplished is described for the layman. (T.R.H.)

11889
NUCLEAR POWER FOR THE PROPULSION OF MERCHANT SHIPS. S. L. Smith and J. E. Richards (British Shipbuilding Research Association). J. Joint Panel Nuclear Marine Propulsion 2, 26-40(1958) Apr.

A review is first made of nuclear fuels and fuel costs, and types of reactor available. The prospects for the commercial application of nuclear power to ship propulsion are then considered and a study made of the permissible cost for a tanker of 47,000 tons dw. Some consideration of the engineering problems and safety precautions is included. (auth)

11890
NUCLEAR POWER AND SHIPS. F. G. Righton. J. Joint Panel Nuclear Marine Propulsion 2, 41-5(1958) Apr.

The advantages and disadvantages of nuclear reactors for surface vessels and submarines are outlined. Design considerations for reactors, fuel elements, moderators, coolants, and power cycles are tabulated and discussed. The special economic consideration to be made for nuclear power in merchant ships is also discussed. (T.R.H.)

11891
THE TRANSFER FUNCTION OF A STEADILY DIVERGING REACTOR. R. Potter (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nuclear Energy 6, 291-9(1958) May.

In the design of automatic control systems which operate a diverging reactor, e.g., automatic start-up systems, a knowledge of the transfer function of the reactor is required. General expressions for the gain and phase shift of a steadily diverging reactor as functions of frequency are derived. Numerical values have been computed for a reactor with six groups of U^{235} delayed neutrons. "Doubling times" of 1, 5, and 20 sec and mean neutron lifetimes of 10^{-3}, 10^{-4}, and 10^{-5} sec have been considered and results for these values are shown graphically. The results show that the transfer function of a diverging reactor is significantly different from that of a reactor in the steady state. The differences are of such a nature as to decrease the phase and gain margins of stability of the control system. The additional stability margins required can be found from the graphs. (auth)

11892
RESONANCE ABSORPTION IN THE POWER STATION REACTOR. Z. I. Gromova, B. G. Dubovsky, A. V. Kamaev, and V. V. Orlov. J. Nuclear Energy 6, 345-50(1958) May.

One of the important quantities governing the conditions of a chain reaction in a uranium-moderator system is the probability (1−p) that the fission neutrons will undergo resonance absorption during the process of slowing down. At the present day (1−p) cannot reliably be calculated for heterogeneous reactors, so that it has to be determined experimentally. Methods of measuring it are discussed, and the corrections which must be applied for neutron leakage, uranium fission, and resonance capture are considered. These corrections are substantial in the case of the power station reactor, which operates with uranium containing 5% U^{235}. The resonance escape probability p for this reactor is calculated by three methods and found to be 0.900 ± 0.015. (auth)

11893
NOMOGRAFICAL SOLUTION OF THE CRITICAL EQUATION FOR A REACTOR AND ITS PRACTICAL APPLICATIONS. Jaroslav Pfann and Vladimir Zajic (Inst. of Nuclear Physics, Prague). Jaderna energie 4, 114-22(1958) May. (In Czech.)

Mathematical formulation of the critical equation is analyzed and a nomogram designed for simple evaluation of sphere reactor radii from different material parameters. Diagrams are given to derive data for criticality of other shapes of reactors when the critical dimension of sphere is found but no change in the material of assembly occurs. The way of calculating the thickness of reflector is described and numerical examples are solved. (tr-auth)

11894
CONCEPTS FOR FUTURE NUCLEAR ROCKET PROPULSION. Robert W. Bussard (Los Alamos Scientific Lab., N. Mex.). Jet Propulsion 223-7(1958) Apr.

The fundamentals, problems, and potentialities of rocket propulsion systems powered by nuclear reactors are presented. (W.L.H.)

11895
SHIPPINGPORT. Nuclear Eng. 3, 233-42(1958) June.

The Shippingport plant consists of a pressurized-water reactor with a heat output of 231 Mw operating at 2,000 psi and generating steam by four coolant loops, only three of which are necessary for full-load operation. This arrangement not only gives a standby plant, it eliminates a number of manufacturing problems that would arise if a single loop were used, since it would necessitate pumps, valves, and pressure parts considerably larger than anything ever built before. Control is based on constant average coolant temperature, rather than on constant steam pressure, on account of simpler reactor control. This decision took advantage of the PWR's inherent negative temperature coefficient. Other design concepts included the complete enclosure and hermetic sealing of all systems containing primary coolant and the extensive use of corrosion-resistant materials. Aspects of the plant discussed include plant enclosure, pressure vessel, core, seed elements, blanket elements, core cage, cooling system, steam plant and turbine, and control and instrumentation. (A.C.)

11896
REACTOR G1 AT MARCOULE. Nuclear Eng. 3, 258 (1958) June.

The Marcoule Reactor (G-1) may be classed as a pioneer in the field of nuclear reactors. This natural uranium air-cooled reactor came into operation Jan. 7, 1956. In the original scheme it was intended as a plutonium-producing pile only but was modified in the design stage to recover something over 5,000 kw of electricity by means of an air−water heat exchanger, flash boilers, and a vertical turbine. (A.C.)

11897
ELECTRONIC ANALOG SIMULATION OF AN IN-PILE CIRCULATING FUEL LOOP. Mark T. Robinson, Joseph F. Krause, Francis P. Green, and Donald F. Weekes (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 3, 648-59(1958) June.

An electronic analog is described which was used to study the thermal behavior of a small circulating fuel loop intended for in-pile studies of molten fluoride reactor fuels. Results of a typical study are presented. (auth)

11898
EFFECT OF URANIUM RECYCLE ON TRANSURANIC ELEMENT BUILDUP. E. D. Arnold (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 3, 707-25(1958) June.

The buildup of the important transmutation products in irradiated uranium was calculated. Significant quantities of such products are produced upon irradiation with pile neutrons. These quantities are further in-

creased with subsequent recycle through power reactors. The nuclides are U^{236}, U^{237}, Np^{237}, and Pu^{238}. Variables included were: irradiation levels of 6×10^{19} to 3×10^{21} n/cm^2; effect of recycle in the range 1 to 400 cycles and infinite recycle; initial fuel enrichment in the range of 0.5 to 3.0% U^{235}; and the effect of fraction of U^{236} removed by a gaseous diffusion plant reconcentration of U^{235} in the range 0 to 100% removal. This last variable depends on the operational characteristics of the diffusion plant. The buildup of transmutation products may have many appreciable effects on the design and operation of fuel recycle. The decay time required will increase as a result of higher concentrations of U^{237}; chemical separation plants may be required to separate Np^{237} as well as uranium, plutonium, and fission products; and the buildup of Pu^{238} in the plutonium product may create additional biological or handling problems. An important conclusion of this work is that all problems resulting from isotope buildup in the U^{235} buildup chain may be decreased in seriousness by approximately an order of magnitude with removal of about 25% of the U^{236} by re-enrichment in a gaseous diffusion plant. (auth)

11899

EIGHT REACTOR TYPES, A THERMODYNAMIC COMPARISON. S. Baron (Burns and Roe, New York). Nucleonics 16, No. 6, 64-7(1958) June.

The eight most advanced types of reactors are compared in terms of power-cycle efficiency, auxiliary power requirements, feedwater heaters and temperatures, and over-all efficiency. Design parameters of operating prototypes were scaled so as to be properly comparable. (W.D.M.)

11900

UPPING EBWR'S POWER. James A. DeShong, Jr. (Argonne National Lab., Lemont, Ill.). Nucleonics 16, No. 6, 68-72(1958) June.

The program for determining the maximum stable operating power for the Experimental Boiling Water Reactor was divided into four parts: First, extensive power-response measurements were made with a reactivity oscillator at powers up to 20 Mwh. Then an expression for the power-to-reactivity feedback transfer function was chosen that gave the best fit to the data. The transfer function was extrapolated to higher powers and examined theoretically for stability in the region of 40 Mwh. Finally, after minor preparations for larger heat removal, the reactor was taken up to the proposed new power level. A good theoretical model of the reactivity feedback loops and a method for predicting stability of boiling-water reactors at higher power levels were developed. (W.D.M.)

11901

VOID-INDUCED POWER DISTORTION IN BOILING-WATER REACTORS. John W. Weil (General Electric Co., San Jose, Calif.). Nucleonics 16, No. 6, 90, 92-4 (1958) June.

The formation of steam bubbles in the core reduces reactivity and causes the power peak to shift away from this region. It is found that steam voids in the core of a large boiling water reactor can cause power-distribution distortions large enough to be of engineering significance. The examples used and the conclusions are applicable to all boiling water reactors that use light water and the dual-cycle principle. (W.D.M.)

11902

WATER-CHANNEL PEAKING FACTORS. R. W. Deutsch (General Nuclear Engineering Corp., Dunedin, Fla.). Nucleonics 16, No. 6, 95-9(1958) June.

In light water reactors the presence of a water channel adjacent to the fuel-moderator region introduces a power peak at the channel boundary. Such peaking has considerable effect on the heat transfer and burnout characteristics of fuel elements in the viscinity of the channel boundary. Since the local neutron flux may be considerably higher than the average flux, there is a possibility of boiling as well as high fuel burnout. A simple procedure is offered that provides certain design criteria to evaluate peaking of intersecting slabs in a complex geometry. (W.D.M.)

11903

BIGGER AND BETTER SWIMMING-POOL REACTORS. Paul N. Garay (General Electric Co., San Jose, Calif.). Nucleonics 16, No. 6, 99-101(1958) June.

The trend toward higher fluxes and consequent higher powers in swimming pool reactors has created new problems in the design of nonnuclear parts of the system. The problems of radioactivity in the water and shrinkage, leakage, and thermal stresses in the pool structure are discussed. (W.D.M.)

11904

DESIGN OF A RESEARCH REACTOR WITH NATURAL URANIUM AND HEAVY WATER WITH RESPECT TO PHYSICAL PARAMETERS. K. Meetz and W. Häfele. Nukleonik 1, 1-9(1958) Apr. (In German)

The physical questions arising in the design of a research reactor are classified and a systematic answer is made. As an example a research reactor which uses natural uranium as the fuel element and heavy water as a moderator and coolant was considered. The reactor core is of a cylindrical form (radium R_w and height l_w) and is surrounded radially as well as vertically by a reflecting medium which means a reflector economy of δ_r or δ_z. The total power of the reactor is Q. The uranium in the form of cylindrical rods (radius a) is placed in the triangulation point of a quadratic lattice (mesh width $d = \sqrt{\pi}\, b$; b = radius of the Wigner-Seitz unit cell). The function of the design was the determination of the seven reactor variables Q, R_w, l_w, δ_r, δ_z, a, and b. The design was based on the conditions that the reactivity excess always be $\Delta k = 10\%$, that the maximum thermal flux ϕ_T^{max} and the maximum fast flux ϕ_S^{max} be as large as possible, and that the maximum temperature T_{max} on the aluminum cladding of the uranium rods remain 100°C below the safety range. The power is a multiplicative parameter and was therefore normalized to a value Q = 12 Mw. The variables R_w, l_w, δ_r, and δ_z were determined under the supplementary condition I for each lattice structure (a, b) so that ϕ_T^{max} was as large as possible. Therefore all physical variables were interpreted as functions of the lattice structure (a, b) and could be constructed in the form of a system of curves in the a–b plane. With this diagram it is then simple to select a and b so that the temperature of the aluminum cladding is in the proper range. The conditions concerning ϕ_T^{max} and ϕ_S^{max} are contradictory and lead to a compromise in which one can still incorporate the desire for a large irradiation capacity $\Sigma_p V_p$ (Σ_p is the absorption cross section and V_p is the total volume of absorbent introduced.). (tr-auth)

11905

REMARKS ON THE THEORY OF RESONANCE ESCAPE IN HOMOGENEOUS REACTORS. W. Oldekop (Siemens-Schuckertwerke AG., Erlangen). Nukleonik 1, 19-21 (1958) Apr. (In German)

A method for the calculation of the resonance escape probability p in homogeneous reactors is given. The method is based on no special hypothesis concerning

the effective cross section, and it permits an accurate estimation of the well-known approximation $p = \exp [-(1/\xi) \int_E^{E_0} (\Sigma a/\Sigma) (dE/E)]$. (tr-auth)

11906

ON A SIMPLE REACTOR SIMULATOR. Wolfram Ziegler (Siemens-Schuckertwerke AG., Erlangen). Nukleonik 1, 27-9(1958) Apr.

A new circuit was investigated which incorporates two unique drift-compensated amplifiers connected in series and which responds directly to the parameter ρ. The principle of the circuit is described and results obtained with it are given. (J.S.R.)

11907

"TWO AND A HALF GROUP" EQUATIONS AND THEIR APPLICATION TO URANIUM–WATER SYSTEMS. Jacek Arkuszewski (Inst. of Nuclear Research, Polish Academy of Sciences, Warsaw). Nukleonika 3, 166-79 (1958). (In Polish)

A review is given of the physical properties of uranium-water reactors, and a four group method of neutron calculations is offered. The four-group equations based on the simple age-diffusion theory, were developed by the Galanin method. These equations are reduced to the so-called "two and a half group" equations. The boundary conditions for these equations are included. (tr-auth)

11908

WORK ON THE DESIGN OF THE SECOND POLISH RESEARCH REACTOR. Krystyna Kowalska (Inst. of Nuclear Research, Polish Academy of Sciences, Warsaw). Nukleonika 3, 180-3(1958). (In Polish)

The criteria for the selection of the second Polish research reactor are given. The thermal and nuclear characteristics for the selected reactors are presented. The present status of the project and the future program are described. (tr-auth)

11909

LINES OF REACTOR DEVELOPMENT. (I). M. Bogaardt. R C N Bull. 2, 53-6(1958) May. (In Dutch)

In this first article of a series on reactors, a number of reactor types which are being developed in various parts of the world are discussed. Their stage of present development and the future possibilities are considered. (J.S.R.)

11910

CODE PROBLEMS IN THE DESIGN OF NUCLEAR POWER PLANTS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 79, Session 3. John Zickel (General Electric Co., San Jose, Calif.). New York, American Institute of Chemical Engineers, 1958. 13p.

The difficulty of designing the various components of a nuclear power plant, strictly in accordance with the appropriate code, is discussed. In conclusion, it is recommended that a unified code for nuclear systems be undertaken. (auth)

11911

CONTROL ROD DRIVE MECHANISMS FOR HERMETICALLY SEALED PRESSURIZED LIGHT WATER NUCLEAR POWER REACTORS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 80, Session 6. John J. Gertz and James W. Flaherty (Westinghouse Electric Corp., Pittsburgh). New York, American Institute of Chemical Engineers, 1958. 40p.

A multitude of complex design problems were encountered and overcome during the development of drive mechanisms suitable for positioning control rods in pressurized water nuclear power reactors. These mechanisms are mounted atop the pressure vessel and are contained within the pressure boundary of the hermetically sealed primary system. One drive mechanism is required for each control rod. A detailed discussion of applied electromechanical mechanism designs is presented, and various experimental designs are summarized. The strong and weak points of the experimental devices are weighed with a view toward future application. (auth)

11912

START UP AND OPERATION OF THE SODIUM REACTOR EXPERIMENT. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 81, Session 7. L. E. Glasgow, J. E. Owens, and D. H. Johnson (Atomics International, Canoga Park, Calif.). New York, American Institute of Chemical Engineers, 1958. 23p.

Operation of the SRE has been quite successful thus far. The reactor and the associated systems have exhibited excellent stability. Maintenance has been relatively easily accomplished. Several improvements in operating procedures and in the design have already been made as a result of operating experience gained to date. Two important changes which will be made in the near future are the addition of a pump to reduce the magnitude of the moderator cooling and an eddy current brake to minimize thermal stresses subsequent to a scram. The rather slow approach to full power on the SRE is consistent with the philosophy of a high-temperature reactor experiment, which will be continually modified and improved in order to further the technology of the sodium graphite reactor. A full-scale reactor designed with information available from the operation of the SRE could be started up much more quickly. (auth)

11913

TESTING REQUIRED FOR FULL POWER OPERATION AT SHIPPINGPORT ATOMIC POWER STATION. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 83, Session 7. Stanley G. Schaffer (Duquesne Light Co., Shippingport, Penna.). New York, American Institute of Chemical Engineers, 1958. 47p.

A discussion is presented of the testing considered necessary to assure that the components and systems, as designed, will satisfy functional requirements and can be operated with no hazard to personnel or equipment. The entire test program is divided into five periods covering inspection of material and equipment during construction; testing of all components, systems, controls, indicators and alarms prior to the installation of a nuclear core; approach to criticality and low power operation after the core installation; testing of the turbine-generator plant throughout the power range using the reactor as the heat source; and finally the determination of Station limitations. The paper discusses three of these periods, omitting the construction and limitation periods. (auth)

11914

CHEMICAL OPERATING EXPERIENCE AT THE ARMY PACKAGE POWER REACTOR. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 68, Session 10. A. L. Medin and W. S. Brown (Alco Products, Inc., Schenectady, N. Y.). New York, American Institute of Chemical Engineers, 1958. 16p.

The chemical operating experience obtained at the Army Package Power Reactor is described. Data on the

impurities and radioactivity in the primary water and the effectiveness of the purification system are presented. The importance of chemical technology in the design, construction, and operation of pressurized water reactor power plants is pointed out. (auth)

11915

PROPOSED FUEL HANDLING FACILITIES FOR PRPR AT HANFORD. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 88, Session 10. Henry J. Bellarts (General Electric Co., Richland, Wash.). New York, American Institute of Chemical Engineers, 1958. 11p.

The underwater part of the fuel handling system for the Plutonium Recycle Program Reactor at Hanford is described. A pair of long, hinged booms are used. These meet at the containment vessel shell to form a straight track thru a special valve at that location. The general arrangement for handling the long fuel element by means of a large fueling vehicle is described. (auth)

11916

PLANNING FOR THE STARTUP OF THE DRESDEN NUCLEAR POWER STATION. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 90, Session 10. K. T. Perkins and H. K. Hoyt (General Electric Co. and Dresden Nuclear Power Station). New York, American Institute of Chemical Engineers, 1958. 12p.

Plans are briefly discussed for station startup including organization of station staff, selection and training of station personnel, and preparation of an operations program. (A.C.)

11917

LONG-LIVED CIRCULATING ACTIVITY DURING APPR-1 700-HOUR TEST. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 92, Session 10. W. J. Small, J. L. Zegger, and A. L. Medin (Alco Products, Inc., Schenectady, N. Y.). New York, American Institute of Chemical Engineers, 1958. 19p.

Cobalt-58,-60, iron-55,-59, and chromium-51 are present and account for approximately 80% of the long-lived gamma activity. None of these nuclides is approaching equilibrium value after 700 equivalent full power hours. The (n-p) reaction cannot be neglected. An (n-p) product, Co^{58}, has four times the activity of the highest activity produced by an (n-γ) reaction, Fe^{59}, at the end of 700 equivalent full power hours. The behavior of long-lived nuclides is not adequately described by the simple activation equation. The relative and absolute amount of Co^{60} increases with time. (auth)

11918

WATER TREATMENT PROCESS FOR THE DRESDEN NUCLEAR POWER STATION. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 130, Session 10. H. D. Ongman (General Electric Co., San Jose, Calif.). New York, American Institute of Chemical Engineers, 1958. 15p.

The heat cycle of the Dresden Nuclear Power Station utilizes a boiling water reactor operating on a dual cycle. Saturated steam at 930 psi and 500 psi is supplied to the turbine at separate admission points. The total flow of these two streams is about 2.6×10^6 pounds per hour. Predicted system corrosion rates are given. Full flow condensate and bypass reactor water demineralization is used to remove corrosion products and other water impurities. A description of the secondary steam system chemical treatment is given. (auth)

11919

DIRECT CYCLE REACTORS FOR AIRCRAFT NUCLEAR PROPULSION. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 93, Session 11. T. Szekely (General Electric Co.). New York, American Institute of Chemical Engineers, 1958. 11p.

The design requirements of direct air-cycle reactors for application to aircraft nuclear propulsion are briefly presented. A summary discussion is made on reactor design problems arising from the interaction of thermodynamic, nuclear, geometric, and aerodynamic criteria for optimum design. Also presented are parametric curves which are helpful in design optimization of the reactor. (auth)

11920

TRENDS IN RADIATION PROTECTION WITH NUCLEAR REACTORS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 49, Session 12. W. H. Truran (General Electric Co., Schenectady, N. Y.). New York, American Institute of Chemical Engineers, 1958. 7p.

The trend is to design inherent reliability into nuclear power plants—their operating, handling, and monitoring equipment—so that operating personnel and the public are adequately safeguarded without the necessity of continuous search by personnel for radiation hazards. Automatic radiation monitoring and analytical equipment will provide for future nuclear power plants a radiation protection program which is less obtrusive and less costly. (A.C.)

11921

REACTOR PHYSICS AND CORE DESIGN OF THE MERCHANT SHIP REACTOR. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 96, Session 13. P. M. Wood and Z. Levine (Babcock and Wilcox Co., Lynchburg, Va.). New York, American Institute of Chemical Engineers, 1958. 19p.

In the economics of present day pressurized water power reactors, the core fabrication cost is a more important factor than fuel inventory charges. The design philosophy of the NMSR has been to minimize core fabrication cost by providing liberal manufacturing tolerances and a long core life. Fringe benefits of this philosophy are liberal thermal and nuclear design requirements and large margins of safety against operational mishap. (auth)

11922

THE NUCLEAR DESIGN OF AIRCRAFT REACTORS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 97, Session 13. D. S. Selengut (General Electric Co., Evendale, Ohio). New York, American Institute of Chemical Engineers, 1958. 19p.

Nuclear design can be defined in terms of the requirements for criticality, control, and desired power distribution—subject to the limits imposed by air flow, thermodynamics, structural, and materials requirements. Difficulties arise from the large number of constraints and the strong interaction of the design variables. Meeting these requirements entails a closely integrated program of analysis and experiment, in which the main tools are flexible and mockup critical assemblies, and large scale digital computers. (auth)

11923

PHYSICS OF REACTOR FOR THE IRRADIATION OF BULKY MATERIALS AND EQUIPMENT. Presented

at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 126, Session 13. D. L. Fischer, M. L. Weiss, and B. Wolfe (General Electric Co., San Jose, Calif.). New York, American Institute of Chemical Engineers, 1958. 11p.

The physics design of a reactor for bulk irradiation experiments is described. The reactor is to be used in performing experiments to determine the effects of radiation on aircraft components. Calculations described include the evaluation of the following reactor characteristics: flux distribution and reactivity, leakage fluxes available for experiments, void and temperature coefficients, excess reactivity requirements, and control rod worth. The method of calculation of reactivity was checked against known critical experiments. Calculated leakage fluxes are compared to values measured at the Tower Shield Facility under conditions simulating this reactor. (auth)

11924

AN EVAPORATIVELY COOLED REACTOR. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 99, Session 14. W. G. Camack and G. Leppert (Lockheed Missile Systems Div., Palo Alto and Stanford Univ., Calif.). New York, American Institute of Chemical Engineers, 1958. 23p.

Because of the change of saturation temperature with static head, liquid heated to saturation at the bottom of a pool becomes superheated as it rises to the pool top and, as a result, evaporates rapidly. For example, Bonilla, et al., obtained evaporation rates equivalent to 10^5 Btu/hr ft^2 without boiling (i.e., bubble formation) in a pool of mercury 2 cm deep at 4 mm absolute pressure. Heidrich's experiments with evaporating superheated water gives a good picture of the heat transfer mechanism involved by showing that substantial temperature differences exist between the bulk of the liquid and the heated and free surfaces, although the bulk liquid temperature is nearly constant with depth. Evaporative cooling could be employed in a reactor system utilizing the coolant vapor directly as the turbine fluid. Such a system would have many of the advantages of a boiling system (e.g., elimination of the secondary heat exchanger) without the limitations and stability problems inflicted by boiling in the core. Mercury is shown to be a possible fast reactor coolant, while diphenyl is attractive as a thermal reactor coolant-moderator. (auth)

11925

THE ARMOUR DUST FUELED REACTOR (ADFR) CONCEPT. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 100, Session 14. D. Kurcoff and F. Narin (Armour Research Foundation, Chicago). New York, American Institute of Chemical Engineers, 1958. 14p.

The ADFR concept is primarily one of a new fuel form—fissionable dust carried in an inert gas. It has all the advantages of any fluid-fueled system with greatly reduced corrosion and inherent high temperature capability. Temperatures of 2,000 to 3,000°F appear feasible in an all ceramic system. Thermal breeding seems assured due to the virtual elimination of neutron poisons. Dust-fueled reactors appear promising for process heat, electric power, or high flux testing applications. (auth)

11926

ANALYSIS OF THE PLUTONIUM RECYCLE PROGRAM REACTOR HAZARDS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 46, Session 19. N. G. Wittenbrock (General Electric Co., Richland Wash.). New York, American Institute of Chemical Engineers, 1958. 14p.

Any reactor is capable of releasing an enormous quantity of energy in a very short time in the event of an uncontrolled nuclear excursion. Even though a particular reactor may be so designed that an uncontrolled nuclear excursion is extremely improbable an objective analysis of the hazards must be made to insure that nothing has been overlooked to give the greatest possible degree of public safety. A brief discussion of the analysis of the nuclear hazards of the Plutonium Recycle Program Reactor is the subject of this paper. (auth)

11927

HEALTH PHYSICS FOR AN URBAN NUCLEAR FACILITY. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 106, Session 19. J. W. Baum (Armour Research Foundation, Chicago, Ill.). New York, American Institute of Chemical Engineers, 1958. 23p.

The Armour Research Foundation reactor and hot lab facility are briefly described. A program of measurements both internal and external to the facility has been instituted to insure the safety of the staff and the surrounding community. Problems unique to an urban reactor location are enumerated, and results obtained to date are presented. Techniques in use include sewage and water sampling, city-wide dustfall sampling, air sampling, soil and grass sampling as well as the more common laboratory safeguards. (auth)

11928

CORE THERMAL DESIGN OF ARMY PACKAGE POWER REACTOR-1A. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 107, Session 20. J. O. Brondel (Alco Products, Inc., Schenectady, N. Y.). New York, American Institute of Chemical Engineers, 1958. 26p.

To increase power without boiling, peak possible surface temperatures in all the plate type fuel elements are equalized by full core flow tailoring. To do this, nominal temperatures for a range of flows per element are determined by a heat transfer analysis using thermal neutron flux traverse data obtained from zero power tests. Maximum possible deviations from nominal temperatures are determined from hot channel factors based upon dimensional and operational tolerances. The resultant individual flow requirement of each element establishes the diameter of its particular orifice. (auth)

11929

MODULAR CONCEPTS IN REACTOR CONTROL INSTRUMENTATION. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 50, Session 21. J. L. Cockrell, D. F. Ryan, and J. H. Magee (Leeds and Northrup Co., Philadelphia). New York, American Institute of Chemical Engineers, 1958. 11p.

The basic circuitry of ORNL reactor control instrumentation has been rearranged, and in some cases redesigned, so that more flexibility, reliability and economy are achieved without sacrificing the safety performance of the original designs. Circuits are constructed on a uniform chassis, (plug-in type), called a module and are interconnected in such a fashion that some of them can fail, or be removed from the system for checking, without causing system shutdown. In conjunction with an improved monitoring scheme, the equipment achieves the objectives. (auth)

11930

NUCLEAR POWER PLANT TRANSFER FUNCTIONS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 53, Session 21. E. P. Gyftopoulos and H. B. Smets (Massachusetts Inst. of Tech., Cambridge). New York, American Institute of Chemical Engineers, 1958. 35p.

The dynamic performance of a nuclear power plant is described by means of partial differential equations with respect to time and spatial variables. Therefore, a nuclear plant is a distributed parameter system. Although this is generally recognized, the transfer functions of nuclear reactors and their associated thermal components are usually derived from lumped parameter models and thus the partial differential equations reduce to ordinary differential equations. An attempt is made to derive the transfer functions of a nuclear power plant from the partial differential equations with the assumption that the heat transfer coefficients are independent of temperature. As an example, a conventional steam power plant is considered whose primary source of energy is a gas-cooled liquid metal fueled reactor. However, the method of approach to the reactor itself can be applied, with only minor modifications, to any reactor with a one-phase coolant. The transfer functions of a reactor are derived, and the heat exchanger and the pipes are studied. (auth)

11931

DESIGN OF THE POWER PLANT FOR THE FIRST NUCLEAR MERCHANT SHIP. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 69, Session 22. R. L. Whitelaw (Babcock and Wilcox Co., Lynchburg, Va.). New York, American Institute of Chemical Engineers, 1958. 23p.

The principal features and performance data of the power plant for the first nuclear merchant ship are outlined with particular reference to the reactor system. The design features of the reactor system containment, arrangment, operation, and control are described. The principal components of the reactor system are then covered in detail. The primary system consists of two loops with one steam generator and two main circulating pumps in each loop. The steam generators are of the natural circulation type with bent-tube, U-shell type boilers and with separating drums equipped with cyclone separators and scrubbers. The main circulating pumps employ canned-rotor constant speed motors with two speed windings. Provisions for reactor system maintenance and refueling of the core are shown. The waste disposal system philosophy and equipment are covered. Finally, the various plant safety provisions are outlined. Development work on the plant, presently continuing, promises further improvements before final installation in the ship late in 1959. (auth)

11932

THE CONSOLIDATED EDISON NUCLEAR ELECTRIC GENERATING STATION. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 131, Session 22. O. G. Hanson and F. R. Ward (Consolidated Edison Co. and Babcock and Wilcox Co., New York). New York, American Institute of Chemical Engineers, 1958. 43p.

The Consolidated Edison Company of New York is erecting a nuclear steam electric generating station on the Hudson River 24 miles north of New York City. The station will have an ultimate electrical capability of 275 Mw, 163 Mw from the reactor and 112 Mw from two oil-fired superheaters. The advantages of superheating the saturated steam are discussed. The principal components of both the reactor and conventional portions of the Indian Point Station are described. The reactor, a pressurized water internal thorium converter, is being designed and built by The Babcock & Wilcox Company. It will be the first unit to make use of thorium as the fertile material to supplement the base fuel, highly enriched U^{235}. The ultimate heat capability of the reactor portion of the station will be 585 Mw. The present status of the development, design, manufacturing, and construction work is reviewed. The station is expected to start operations by December 1960. (auth)

11933

CONTROL PROBLEM AREAS IN THE DESIGN OF NUCLEAR AIRCRAFT POWER PLANTS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 111, Session 25. G. E. Gorker (General Electric Co.). New York, American Institute of Chemical Engineers, 1958. 26p.

Some of the control problem areas associated with aircraft reactor power plants, some of which are common knowledge and others which are less familiar, are presented. The behavior of a reactor is compared to the more familiar chemical burner so that the reader may notice some of the differences between the two heat sources. Nuclear instrumentation and control system concepts are discussed to some extent so that more detailed problem areas become apparent. This information may prove to be of some value as a guide to the development of control components intended for reactor applications. (auth)

11934

APPLICATION OF ROOT-LOCUS ANALYSIS TO NUCLEAR REACTOR SYSTEMS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 58, Session 30. E. H. Lemon (Bendix Aviation Corp.). New York, American Institute of Chemical Engineers, 1958. 17p.

The root-locus method of analysis of feedback-control systems and circuits is applied to nuclear reactor systems. For a linear model of reactor, stability and characteristic response as a function of system parameters can readily be ascertained. Rules for drawing and interpreting the root locus are presented. Root loci are drawn and interpreted for two reactor types, one thermal and one fast. (auth)

11935

THE USE OF SIGNAL-FLOW GRAPHS IN KINETIC ANALYSIS OF NUCLEAR REACTORS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 59, Session 30. A. B. Van Rennes (Bendix Aviation Corp., Detroit). New York, American Institute of Chemical Engineers, 1958. 15p.

Signal-flow graphs have long been exploited in feedback-control analysis and can greatly aid in kinetic analysis of nuclear reactors and nuclear reactor systems. Methods are given for formulating the flow graph and for determining rapidly any transfer function of the system so represented. Illustrations which apply these methods to simple reactor systems are provided. (auth)

11936

FUEL IRRADIATION TEST FACILITIES. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 116, Session 31. R. J. Schiltz and D. R. Patterson (Argonne National Lab., Lemont, Ill.). New York, American Institute of Chemical Engineers, 1958. 23p.

A description is presented of the design and operation

of two facilities for irradiation testing specimens of proposed fuel for the two principal power reactor types being developed at Argonne National Laboratory. These facilities offer a relatively simple and inexpensive means for irradiation testing fuel samples while providing sufficient versatility to be adapted to a wide variety of radiation testing problems which may include materials other than fuel. The first facility described is one which is designed to quantitatively determine the effects of simultaneous corrosion and irradiation on proposed fuel alloys for boiling water reactors. The second facility is designed to handle the high power generation of full size fuel pins for EBR-II. (auth)

11937

PROBLEMS IN THE MECHANICAL DESIGN OF SPERT EXPERIMENTAL REACTORS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 117, Session 32. T. R. Wilson and W. M. Hawkins (Phillips Petroleum Co., Idaho Falls, Idaho). New York, American Institute of Chemical Engineers, 1958. 15p.

In designing the three existing SPERT (Special Power Excursion Reactor Tests) experimental reactors, several challenging mechanical design problems were encountered. Although many of the design problems are peculiar to the SPERT reactors, some of the problems may be encountered in other similar nuclear reactors, and therefore be of interest to those engaged in reactor design. Several of the unusual design problems and the methods of approach to the problems employed by the SPERT engineering section are discussed. (auth)

11938

HIGH POWER INTERMEDIATE ENRICHMENT POOL REACTOR. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 118, Session 32. J. Jacobson, W. S. Prince, and R. O. Niemi (General Electric Co., San Jose, Calif.). New York, American Institute of Chemical Engineers, 1958. 24p.

The open-pool reactor or swimming-pool reactor is an extremely versatile reactor for research, training, and isotope production. The reactor described is a 3,000-kw light-water moderated and cooled reactor suspended from a bridge structure in either of two pool sections: a large section for bulk shielding experiments and a small tank section provided with six beam ports, one thermal column, two rabbit tubes, and two vertical tubes. The mechanical design and coolant systems are discussed. Significant features differing from other reactors of this type are indicated. (auth)

11939

MODEL STUDY OF COOLANT FLOW IN THE PWR REACTOR. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 128, Session 33. F. A. Grochowski, H. R. Hazard, J. Sherman, and L. J. Flanigan (Westinghouse Electric Corp., Pittsburgh). New York, American Institute of Chemical Engineers, 1958. 28p.

A quarter-scale flow model was used to study three-dimension flow in the PWR, using air to simulate coolant flow. The model was designed to provide dynamic similarity with the prototype, and constructed to maintain dimensions closely. Standard ASME orifices, static pressure taps, and cylindrical yaw probes were used as primary measuring instruments, with precision inclined manometers and vertical water manometers for pressure measurements. During all modes of operation, core flow distribution was satisfactory, cooling of thermal shields was adequate, and flow throughout the reactor was stable. Accuracy of all measurements was high, and flow distribution data could be reproduced within 0.3 per cent. (auth)

11940

CIVIL ENGINEERING ASPECTS OF THE DRESDEN NUCLEAR POWER STATION. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 61, Session 36. Joseph E. Love, Chester S. Darrow, and Burr H. Randolph (General Electric Co. and Bechtel Corp.). New York, American Institute of Chemical Engineers, 1958. 34p.

A comprehensive description of the arrangement and civil engineering design features of the Dresden Nuclear Power Station is presented. This description stresses design considerations arising from the necessity of containing the reactor and the nuclear steam supply system in a vapor tight sphere. Factors associated with equipment layout, maintenance access, and biological shielding are discussed. Other more conventional types of problems encountered are reviewed in sufficient detail to show the work of the civil engineer in the design and construction of nuclear plants. While the emphasis is on the civil engineering aspects of the plant, the general plant mechanical arrangement is included. A brief discussion of the plant operating cycle is given. (auth)

11941

DESIGN OF EBR-II PRIMARY TANK SUPPORT STRUCTURE. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 73, Session 36. R. W. Seidensticker and S. H. Fistedis (Argonne National Lab., Lemont, Ill.). New York, American Institute of Chemical Engineers, 1958. 15p.

The EBR-II primary tank support structure consists of a system of columns and beams which transmit the loads incurred on the structure of the main internal building foundation. In combination with the biological shield, it forms a "pressure vessel" surrounding the primary tank which contains the reactor and all of the primary system components. The bottom "closure" of the "pressure vessel" is the internal building foundation, which is mass concrete, reinforced with steel bars to act as a pressure vessel head. The material proposed for the columns and beams is a high strength steel, USS Carilloy T-1, which has a yield strength of 90,000 psi and a tensile strength of 105,000 psi at room temperature. Since the primary tank contains approximately 600,000 pounds of sodium at 700°F, it is imperative that the primary tank support structure contain this sodium in the event of a postulated explosive-type nuclear incident in order to avert the secondary, and undoubtedly more severe effect, the sodium-oxygen reaction in the reactor building. As a consequence of this requirement, the structure is designed not in the conventional manner of proportioning members to resist static gravity loads, but to provide sufficient strength to safely resist high pressures of short duration, and to some extent, to provide a blast-resistant structure in order to preserve the integrity of the "pressure vessel" enclosure. (auth)

11942

REACTOR SHIELD PENETRATION CALCULATIONS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 119, Session 36. William E. Edwards and John E. MacDonald (General Electric Co., Evendale, Ohio). New York, American Institute of Chemical Engineers, 1958. 13p.

Application of point-to-point attenuation functions to the calculation of fast neutron and gamma ray dose and energy absorption rates in and around reactor shields is described. A description of IBM-704 programs capable of evaluating attenuation functions along source-receiver paths in complex shields and performing a final integration over a source region is presented. (auth)

11943

SHIELDING FOR AIRCRAFT NUCLEAR POWER PLANTS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 120, Session 36. F. A. Aschenbrenner (General Electric Co.). New York, American Institute of Chemical Engineers, 1958. 12p.

The main function of an airborne aircraft nuclear shield system can be briefly summarized as those of protecting the operating crew from biological radiation damage and protecting aircraft components from excessive activation and material damage. The airborne shield system can also serve a secondary function as part of the shield system necessary for protecting ground handling and maintenance crews. Thus, the shield system must be designed subject to the radiation level constraints which may apply to either the operating conditions, after shutdown conditions, or both. Any shield system used would be expected to constitute the heaviest single item aboard a nuclear powered aircraft. Therefore, power plant performance is quite sensitive to the specific nuclear shield design. Accurate and efficient design procedures must be developed which can be used to calculate optimum shield thicknesses efficiently. Some of the most important problems which must be faced in the design of high performance aircraft shield systems are described. (auth)

11944

CONTAINMENT-VESSEL DESIGN BASIS FOR THE DRESDEN NUCLEAR POWER STATION. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 121, Session 36. G. Sege (General Electric Co., San Jose, Calif.). New York, American Institute of Chemical Engineers, 1958. 35p.

The bases of design of the containment vessel for the Dresden Nuclear Power Station reactor and auxiliaries are presented and discussed. Selection of the containment-vessel type, bases of the design pressure, permissible leakage, structural and leakage testing, and integrity-safeguard provisions (such as post-accident cooling, penetration closure, etc.) are discussed. (auth)

11945

REPROCESSING COSTS FOR FUEL FROM A SINGLE-REGION AQUEOUS HOMOGENEOUS REACTOR. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 66, Session 37. A. C. Jealous and R. J. Klotzbach (Union Carbide Nuclear Co., New York). New York, American Institute of Chemical Engineers, 1958. 18p.

The cost is estimated for a fuel reprocessing plant to recover fissionable, fertile, and moderator materials from irradiated slurry fuel of the Pennsylvania Advanced Reactor, a single-region aqueous homogeneous reactor with 150 Mw of electrical generating capability. The total fixed investment cost for this reprocessing plant is estimated to be $4,550,000, including working capital, preoperational charges, and related factors. The estimated annual operating and maintenance costs, including depreciation charges, are $1,170,000, to which normal profit and income tax increments must be added. The estimate is based on a reprocessing plant designed to process 47 kg of thorium per day for return to the reactor plant. The estimated bare unit reprocessing charge to the utility is 1.12 mills per kwh of electricity before provision for profit and federal income tax; for a 30 percent return on the investment, the unit reprocessing charge is 2.4 mills per kwh of electricity. Estimating the effect of increasing the capacity of the reprocessing plant to service multiple reactors indicates that at least 950 Mw of installed electrical capability, equivalent to six PAR units, is required before the unit fuel reprocessing charges are reduced to less than 1.0 mill per kwh, including a reasonable return on the investment. Off-site solvent extraction decontamination of PAR fuel in a U. S. AEC Multipurpose Plant would cost more than complete on-site reprocessing. (auth)

11946

MODEL STUDIES OF THE FLOW CHARACTERISTICS OF THE FUEL ELEMENTS FOR THE ENRICO FERMI REACTOR. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Orville E. Homeister, Weymouth N. McDaniel, and Raymond A. Yagle (Atomic Power Development Associates, Inc., Detroit and Univ. of Michigan, Ann Arbor). New York, American Institute of Chemical Engineers, 1958. 21p.

Laboratory measurements were made on radial blanket subassemblies of the type proposed for use in the Enrico Fermi nuclear reactor to determine head losses, correct sizes for distributing orifices, and fluid mixing characteristics. A coefficient of eddy diffusivity was measured for the complex geometry so that the distribution of temperature in the proposed nuclear reactor could be estimated more accurately. Head loss measurements were also made on various core subassemblies representing five different arrangements or methods of spacing the small diameter core fuel pins. Several possible methods of reducing these losses were also investigated. For both the radial blanket and the core subassemblies, the flow is parallel to the axis of the rods. The observed losses were generally greater than values predicted with conventional methods. Tests with water were generalized so that the results provide design criteria for liquid sodium which will be used in the reactor. (auth)

11947

PHYSICS AND MATHEMATICS. VOLUME 2. PROGRESS IN NUCLEAR ENERGY, SERIES I. D. J. Hughes, J. E. Sanders, and J. Horowitz, eds. New York, Pergamon Press, 1958. 380p. $14.00.

Progress made since the 1955 Geneva Conference in the basic experimental and theoretical aspects of reactor physics is reviewed ranging from neutron cross section measurements to detailed theory of the behavior of multiplying assemblies. Neutron cross section data for isotopes of Th, U, Np, Pu, and Am are reviewed. Progress on the measurement and theory of reactor spectra is presented. Recently devised techniques for improving the precision of source standardization are covered. The methods of studying neutron diffusion by measuring the response of the moderating system to a short pulse of neutrons are described and compared to conventional methods. The theoretical aspects of reactor physics covered are the following: the theory of resonance escape probability, computational methods for reactor calculation, and a Monte Carlo technique review with special reference to neutron transport theory. (M.H.R.)

11948

NUCLEAR REACTOR EXPERIMENTS. J. Barton Hoag,

ed. Princeton, D. Van Nostrand Company, Inc., 1958. 493p. $6.75.

This is a laboratory book for instruction in the field of nuclear science and engineering. It is intended to introduce scientists and engineers to the problems of designing, constructing, and operating nuclear reactors. Experiments described include radiation detection, moderator and subcritical assemblies, cross sections, operating reactors, heat removal, fuel preparation, corrosion and radiation effects, separation processes, and a metallurgy hot laboratory. (W.D.M.)

11949

NUCLEAR REACTOR THEORY. NUCLEAR ENGINEERING MONOGRAPHS. J. J. Syrett. London, Temple Press Limited, 1958. 87p.

This new series of monographs on nuclear engineering subjects is intended for university and technical college students, research assistants, and qualified technicians who require a broad understanding of those topics of nuclear engineering outside their own field of study. They provide a broad treatment ranging from elementary principles to up-to-date summaries of more advanced theories. This monograph, the second in the series, considers nuclear chain reactions, diffusion of thermal neutrons, slowing down of neutrons, calculation of critical size, lattice calculations, reactor operation at power, and reactor types and fuel cycles. (W.D.M.)

11950

POWER REACTOR TECHNOLOGY. Technical Progress Review, Vol. 1, No. 3. Dunedin, General Nuclear Engineering Corp., 1958. 63p. Available from U. S. Government Printing Office, Washington for $0.55.

Buckling measurements are presented for D_2O moderated graphite lattices. The effects of changes in temperature on the reactivity of graphite lattices are presented. The conversion ratio of the PWR blanket is discussed. The results of capture-to-fission ratio measurements in the EBR-1 are reported. Burnout measurements and heat transfer under supercritical conditions are presented. Transient boiling experiments and dynamics of boiling water reactors are reported. Reactor fuel elements consisting of U and U alloys of high U content, plutonium–aluminum, non-metallic elements of high fuel content, and elements of low fuel content are discussed. Control, moderator, shielding, and structural materials for applications in various reactors are presented. Progress is reported on liquid metal fuel reactors and fast reactors. (W.L.H.)

Nuclear Transformation

11951 NRDC-73(Del.)

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

ON $\bar{\nu}$, THE AVERAGE NEUTRON YIELD PER FISSION. J. S. Story. July 1955. 12p.

A very crude statistical model is applied to see what qualitative predictions can be made about $\bar{\nu}$ as a function (1) of the excitation energy of the fissioning nucleus, (2) of the mass and charge of the fissioning nucleus. Suggestions are made for further experimental work. If current discrepancies between the theory and experiment are confirmed it would be necessary to invoke a more specialized model. (auth)

11952

ON THE WIDTH OF THE GIANT RESONANCE IN PHOTONUCLEAR REACTIONS. Sven A. E. Johansson (Univ. of Lund). Arkiv Fysik 13, 331-8(1958).

A compilation has been made of the width of the giant resonance in photonuclear reactions. The experimental material is discussed, and it is shown in which cases the measured cross-section curves represent the total photonuclear absorption. It turns out that the nondeformed nuclei have a rather constant width. The width of the deformed nuclei is larger and shows considerable fluctuations. The theoretical implications of these facts are discussed. (auth)

11953

ANGULAR CORRELATION OF THE NEUTRONS EMITTED FROM THE REACTION $Be^9(n,2n)Be^8$. Bechir Torki, Klaus Winter, and Ernst Rémy. Compt. rend. 246, 3047-50(1958) May 28. (In French)

The angular correlation of the neutrons with energy higher than 500 kev emitted in the reaction $Be^9(n,2n)Be^8$ was measured. The maximum correlation, obtained at 60°, was 20%. (tr-auth)

11954

CONVERSION SPECTRA OF SOME NEUTRON-DEFICIENT ISOTOPES OF TERBIUM. N. M. Anton'eva, A. A. Bashilov, B. S. Dzhelepov, and B. K. Preobrazhenskii (Zhdanov Leningrad State Univ.). Doklady Akad. Nauk S.S.S.R. 119, 241-3(1958) Mar. 11. (In Russian)

Studies were made of the conversion spectra of neutron-deficient Tb isotopes obtained in reactions Ta + p at 660 Mev. The decay curves based on the changes of conversion peaks with time show that the preparation of Tb contains several isotopes. The results are given of the activities of: $T_{1/2}$ = 8 ± 1 h; 18 ± 1 h; 2.3 ± 0.3 days; 5 ± 1 days; 10, 120, and 200 days. (R.V.J.)

11955

THE (n,2n) REACTION IN Be^9 FOR A NEUTRON ENERGY OF 3.7 Mev. R. Wagner and P. Huber (Univ. of Basel). Helv. Phys. Acta 31, 89-116(1958). (In German)

The mechanism of the (n,2n) reaction in Be^9 at a neutron energy of 3.7 Mev was determined on the basis of the spectrum of the emitted neutrons. As a neutron source the (d,d) reaction with a thick target of D_2O ice was used. The spectrum of the reaction neutrons emitted at less than $\varphi = 90°$ to the incident direction of the (d,d) neutrons was detected with Ilford C_2 plates. The structure of the spectrum indicates a periodic separate emission of both neutrons which means the reaction proceeds by means of an excited state of Be^9. On the basis of the number of proton recoil traces measured in the plates the differential cross section for the $Be^9(n,2n)$ reaction was determined for a neutron energy of 3.7 Mev. The results were $\sigma_{diff}(n,2n) = 39 \pm 8$/mb sterad. (tr-auth)

11956

THE ENERGY DISTRIBUTION OF PROTONS EMITTED IN (n,p) REACTIONS. Judit Németh (Central Research Inst. of Physics, Budapest). Nuclear Phys. 6, 686-90 (1958) May.

If oscillation of the excited nucleus during evaporation is taken into account, the energy of the emitted protons is different in a system related to the nuclear surface from that in the laboratory system. The energy distribution of the emitted protons is qualitatively in good agreement with the experimental data. The spectra of protons emitted in (n,p) reactions from Rh bombarded by 13.2-Mev neutrons were studied. (auth)

11957

ENERGY DISTRIBUTIONS OF PRODUCT PARTICLES FROM NITROGEN-INDUCED NUCLEAR REACTIONS ON BERYLLIUM. Charles D. Goodman and John L. Need (Oak Ridge National Lab., Tenn.). Phys. Rev. 110, 676-82(1958) May 1.

The energy distributions of protons, deuterons, and alpha particles from N^{14} bombardment of Be^9 were measured with a particle-selective counter. The apparatus is described. The results show approximate agreement with the simple statistical assumptions of continuum theory both in regard to the shapes of the spectra and to the relative yields of protons, deuterons, tritons, and α particles. Reasonable agreement with the level-density formula $\omega(E) = \exp\{2[a(E-b)]^{\frac{1}{2}}\}$ is possible with a = 1.1, b = 0 for F^{19}; a = 1.4, b = 0 for Ne^{21}; and a = 2.6, b = 4.9 for Ne^{22}. (auth)

11958

ABSOLUTE CROSS SECTIONS FOR THE REACTIONS $B^{11}(\gamma,2p)Li^9$ AND $C^{12}(\gamma,3p)Li^9$. G. W. Tautfest (Purdue Univ., Lafayette, Ind.). Phys. Rev. 110, 708-12(1958) May 1.

Activation curves for the reactions $B^{11}(\gamma,2p)Li^9$ and $C^{12}(\gamma,3p)Li^9$ were obtained in the energy range 100 to 320 Mev. Targets of boron and carbon were exposed to the bremsstrahlung beam of the synchrotron and the yields of Li^9 measured by counting the delayed neutrons in a moderator-counter assembly surrounding the targets. The activation curves were analyzed by the photon difference method to obtain the cross-section curves as a function of energy. Both cross sections show a pronounced increase above 150 Mev, and have integrated values up to 320 Mev of 2.0 ± 0.3 Mev-millibarns for the reaction $B^{11}(\gamma,2p)Li^9$ and 0.31 ± 0.05 Mev-millibarn for the reaction $C^{12}(\gamma,3p)Li^9$. (auth)

11959

REACTION $Li^6(d,t)Li^5(p)He^4$. R. T. Frost and S. S. Hanna (Johns Hopkins Univ., Baltimore). Phys. Rev. 110, 939-40(1958) May 15.

A study is made of the proton and triton continua from the deuteron bombardment of Li^6 in order to obtain information on the mechanism of the three-particle reaction and on the properties of the ground state of Li^5. Because of the great breadth of this state, an unambiguous interpretation is not possible. The most likely mechanism is $Li^6(d,t)Li^5(p)He^4$, with a Q = 0.80 ± 0.15 Mev for the primary reaction (mass defect of Li^5 = 12.95 ± 0.15 Mev), and a width of the ground state of Li^5 equal to 2.0 ± 0.2 Mev. (auth)

11960

EJECTION OF PHOTOPROTONS FROM LIGHT ELEMENTS BY 45-110 Mev BREMSSTRAHLUNG. C. Whitehead, W. R. McMurray, M. J. Aitken, N. Middlemas, and C. H. Collie (Clarendon Lab., Oxford). Phys. Rev. 110, 941-53(1958) May 15.

Absolute differential cross sections for the production of photoprotons from carbon, lithium, and beryllium have been measured. A proton telescope was used to select protons of energy 37, 47, 55, 63, and 78 Mev, using bremsstrahlung beams with peak energies from 40 to 110 Mev. Measurements were taken at angles of 36, 51, 71, 90, 119, and 129°. Comparison of the carbon results with the calculations of Dedrick indicate that the principal contributions to the cross sections arise from quasi-deuteron interactions. Some evidence is presented that other processes occur near threshold. Measurements of neutron-proton coincidences were made showing that this direct manifestation of the quasi-deuteron interaction occurs at these energies. (auth)

11961

ON THE INTERACTION OF ANTIPROTONS AND NUCLEI. P. E. Nemirovskii. Soviet Phys. (Doklady) 2, 45-7(1957) Jan.-Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 6550.

11962

α-DECAY FINE STRUCTURE OF EVEN-EVEN NUCLEI. V. G. Nosov. Soviet Phys. (Doklady) 2, 48-53(1957) Jan.-Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 6504.

11963

(n,α) REACTIONS OF 14-Mev NEUTRONS WITH CADMIUM. B. G. Dzantiev, V. N. Levkovskii, and A. D. Malievskii (Inst. for Chemical Physics, Academy of Sciences, USSR). Soviet Phys. (Doklady) 2, 135-8(1957) Mar.-Apr.

Metallic cadmium and its salts were irradiated with 4-Mev, 14-Mev, and fission neutrons. The radioactive palladium was precipitated and counted. No radioactivity was observed in the palladium fraction from the 4-Mev irradiation. After irradiation with fission neutrons a 14-hr palladium activity was observed. Three radioactive components with half lives of 22 ± 1 min, 5.5 ± 0.2 hr, and 14.0 ± 0.5 hr were observed following irradiation with 14-Mev neutrons. The 14-hr activity was assigned to Pd^{109} and the 22 min activity, to Pd^{111}. The 5.5-hr activity was assigned to Pd^{111m}. The cross sections for the reactions $Cd^{112}(n,\alpha)Pd^{109}$, $Cd^{114}(n,\alpha)Pd^{111}$, $Cd^{114}(n,\alpha)Pd^{111m}$, and $Ag^{109}(n,p)Pd^{109}$ was calculated for 14-Mev neutrons. The values were 1.35 ± 0.27, 0.51 ± 0.13, 0.13 ± 0.04, and 10.5 ± 2.0 mb, respectively. (J.S.R.)

11964

Pd^{111m}. B. G. Dzantiev, V. N. Levkovskii, A. D. Malievskii, and M. V. Serdobov. (Inst. for Chemical Physics, Academy of Sciences, USSR). Soviet Phys. (Doklady) 2, 154-7(1957) Mar.-Apr.

It was established earlier (Dzantiev, et al., Soviet Phys. (Doklady) 2, 135-8(1957) Mar.-Apr.) that when cadmium is irradiated with 14-Mev neutrons three palladium activities are observed, with half lives of 22 min, 5.5 hr, and 14 hr. The 22-min and 14-hr activities were assigned to Pd^{111} and Pd^{109}, but no definite assignment was made for the 5.5-hr activity. A radiochemical investigation based on the Szilard-Chalmers effect for nuclear isomers was made to identify the 5.5-hr activity and it was definitely identified as Pd^{111m}. The internal conversion coefficient of the isomeric transition $Pd^{111m} \rightarrow Pd^{111}$ was calculated as $\alpha \geq 0.185$. The relative yields of Pd^{111} and Pd^{111m} in the (n,γ) reaction was also determined. (J.S.R.)

11965

HELIUM AND ARGON PRODUCTION IN IRON TARGETS BY ENERGETIC PROTONS. O. A. Schaeffer and J. Zähringer (Brookhaven National Lab., Upton, N. Y.). Z. Naturforsch. 13a, 346-7(1958) Apr. (In German)

The cross sections for the production of helium and argon isotopes by the irradiation of iron with 0.16, 0.43, and 3 Bev protons were determined. The ratio He^3/He^4 was measured. At all proton energies more He^3 was produced than T, a result in disagreement with previous measurements. The cross section of He^3 and T production is graphed as a function of the proton energy and shows that the He^3 yield is larger by a factor of 2.4 than the T yield. The production cross section for argon at a proton energy of 0.43 Bev yields a Gaussian curve. The Ar^{38}/Ar^{36} yield ratio was 8.6 for 0.43-Bev protons. (J.S.R.)

11966

PHOTODISINTEGRATION OF HELIUM. II. A. N. Gorbunov and V. M. Spiridonov (Lebedev Inst. of Physics, Academy of Sciences, USSR.). Zhur. Eksptl'.

i. Teoret. Fiz. 34, 862-5(1958) Apr. (In Russian)

A cloud chamber was employed to study the $He^4(\gamma,n)He^3$ reaction. The method of treatment of the He^3 track data is described. The dependence of the reaction cross section on the γ-quantum energy and reaction products angular distributions were measured. σ_{tot} and $\sigma_b = \int \sigma\,(W)W^{-1}\,dW$ are computed from the curve $\sigma(W)$. (tr-auth)

11967

PHOTODISINTEGRATION OF HELIUM. III. A. N. Gorbunov and V. M. Spiridonov (Lebedev Inst. of Physics, Academy of Sciences, USSR.). Zhur. Eksptl'. i Teoret. Fiz. 34, 866-73(1958) Apr. (In Russian)

Investigation of the reaction $He^4(\gamma,pn)D$ and data on investigation of photodisintegration of He^4 are presented. The dependence of the cross section of the reaction (γ,pn) on γ-quantum energy and the angular distributions of the neutrons and protons produced in this reaction are presented. Correlation in the emission of protons, neutrons and deuterons is studied. $\sigma_{int} = 95 \pm 7$ Mev · mb and $\sigma_b = (2.4 \pm 0.15)$ mb are computed from the curves of the cross sections for the (γ,p), (γ,n) and (γ,pn) reactions on He^4. The results are discussed with the purpose of elucidating the nature of the interaction between γ-quanta and the He^4 nucleus at various γ-quantum energies. The results are also compared with the theoretical predictions of photodisintegration of He^4. (tr-auth)

Particle Accelerators

11968 MURA-407

Midwestern Universities Research Assn., Madison, Wis.

RESONANCE SURVEY IN THE ELECTRON MODEL SPIRAL SECTOR FFAG ACCELERATOR. W. A. Wallenmeyer. June 2, 1958. 21p. Contract AT(11-1)-384. $4.80(ph OTS); $2.70(mf OTS).

The relative intensity of the electron beam in the spiral sector model was determined over a large part of the machines $\nu_x - \nu_z$ stability region in order to study the effects of various resonances. The mean field index k was varied from about 0.2 to 1.16 and the flutter was varied from about 0.57 to 1.6. This has produced an observed variation in the radial betatron frequency, ν_x, from 1.18 to about 1.8 and in the vertical betatron frequency, ν_z, from < 0.4 to > 1.9. The beam is completely destroyed everywhere along the integral resonance ($\nu_z = 1$). The half integral resonances observed are $2\nu_z = 1$, $2\nu_z = 3$, $2\nu_x = 3$, $\nu_x + \nu_z = 2$, and $\nu_x + \nu_z = 3$, of which only $2\nu_z = 1$ and $\nu_x + \nu_z = 3$ show complete destruction of the beam along their entire length. The beam is also observed to be effected at the positions of the $\nu_x + 2\nu_z = 4$, $\nu_x + 2\nu_z = 5$, and $3\nu_z = 2$ third integral non-linear resonances. Some effect of the Walkinshaw difference resonance ($\nu_x - 2\nu_z = 0$) is observed. (auth)

11969

A COCKCROFT AND WALTON 200 kv ACCELERATOR FOR THE GENERATION OF NEUTRONS. M. Paic, K. Prelec, P. Thomaš, M. Varičak, and B. Vošicki (Inst. of Physics, Zagreb). Glasnik mat.-fiz. i Astron. Ser. II, 12, 269-87(1957). (In French)

A 200 kv Cockcroft-Walton accelerator which produces neutrons by the D-D or D-T reactions is described in detail. The high-voltage generator, the ion source, the accelerator tube with focussing apparatus, pumps, control console, and deuterium-producing apparatus are depicted and discussed. (T.R.H.)

11970

THEORETICAL ASPECTS OF THE SOVIET 10 GeV SYNCHROTRON. M. S. Rabinovich (Joint Inst. of Nuclear Research, Academy of Sciences, USSR). J. Nuclear Energy 6, 351-69(1958) May.

Methods are developed for analyzing the behavior of weak-focusing synchrotrons and, in particular, for calculating design parameters. Free oscillations, orbit distortions, resonances in free and phase oscillations, and injection, are considered. The theory is applied to the 10 Bev synchrotron of the USSR Academy of Sciences. (auth)

11971

CZECHOSLOVAK INDUSTRIAL 15 Mev BETATRON. Karel Rytina (Inst. of Atomic Tech., Prague). Jaderna Energie 4, 85-92(1958) Apr. (In Czech)

Descriptions are given of the design and parameters of the first Czechoslovak industrial betatron. The performance and the fields of the betatron application are discussed. (tr-auth)

11972

A MAGNETIC BEAM FOCUSING AND ANALYZING SYSTEM FOR CYCLOTRONS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 51, Session 13. K. L. Boring, R. F. Edgar, and L. H. Stauffer (General Electric Co.). New York, American Institute of Chemical Engineers, 1958. 14p.

A magnetic strong-focusing system for a 60-in. cyclotron is described. It consists of a magnetic shielding channel, two quadrupole focusing magnets, a remotely adjustable entrance aperture, and a magnetic beam analyzer. Valving monitoring and control equipment are also described. The system delivers several microamperes of 20-Mev deuterons or 40-Mev alpha particles to a shielded target room. (auth)

11973

THE ROLE OF PARTICLE ACCELERATORS IN REACTOR RESEARCH AND DEVELOPMENT. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 95, Session 13. E. Alfred Burrill and A. John Gale (High Voltage Engineering Corp., Burlington, Mass.). New York, American Institute of Chemical Engineers, 1958. 15p.

The increasingly prominent position of particle accelerators in reactor technology is discussed, with reference to specific reactor and development projects now in existence or under contemplation. These electro-nuclear machines synthetically produce many of the nuclear particles and radiations of interest to reactor specialists, and are therefore of importance in the acquisition of fundamental physics data, reactor engineering values, and associated information relating to the design, construction, utilization, and future of reactor systems. (auth)

11974

PRODUCTION OF BEAMS OF POLARIZED PROTONS BY THE ACCELERATION OF PROTONS DERIVED FROM POLARIZED HYDROGEN MOLECULES. R. L. Garwin (Columbia Univ., New York). Rev. Sci. Instr. 29, 374-6(1958) May.

A conventional Stern-Gerlach separation of hydrogen molecules is proposed for the supplying of a radio-frequency or PIG ion source of standard type to produce microampere beams of polarized protons for acceleration in electrostatic accelerators, cyclotrons, etc. The long nuclear relaxation time of molecular hydrogen gas allows the accumulation of polarized protons (as molecules) for the production of microampere average

beams by means of a pulsed ion source. The polarized protons after acceleration have the energy- and angular-spread characteristic of the machine with which they were accelerated. There is no apparent reason why polarized H^- may not be produced in the same strong-field rf ion source, accelerated in a weak field to preserve polarization and stripped in a tandem machine, all without significant depolarization. (auth)

11975

ACCOUNT OF COLLECTIVE INTERACTION OF ELECTRONS IN CYCLIC ACCELERATORS. L. M. Kovrizhnykh and A. N. Lebedev (Lebedev Inst. of Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 984-92(1958) Apr. (In Russian)

A mathematical technique is developed which permits one to take into account collective interaction of particles in cyclic accelerators. The method is applied to the problem of capture of electrons under betatron acceleration conditions. The results obtained are compared with experiment. (tr-auth)

11976

RELATIVISTIC PROBLEM OF ELECTRON MOTION IN AXIALLY SYMMETRIC MAGNETIC FIELD, SHIFTING ALONG THE AXIAL SYMMETRY. M. V. Konyukov and Ya. P. Terletskii (Moscow State Univ.). Zhur Eksptl'. i Teoret. Fiz. 34, 1003-5(1958) Apr. (In Russian)

A new variation is offered for the relativistic problem of electron motion in an alternating axially symmetric magnetic field in which the bottle shaped magnetic field shifts at a changing or constant rate along the axial symmetry. This variation can be applied as a theoretical basis for the new type of linear induction accelerator—the linear betatron. (R.V.J.)

Radiation Absorption and Scattering

Refer also to abstract 11801.

11977 AFOSR-TN-57-425

Florida State Univ., Tallahassee.

PRECISION STUDIES OF X-RAY ATTENUATION COEFFICIENTS. I. DESIGN OF THE EXPERIMENT. Technical Report No. 7. Richard D. Deslattes. 1958. 18p. Contract AF18(603)-64. (AD-136414).

The meaning of an x-ray attenuation coefficient is considered from the point of view of an experimental determination of its value. Consideration is given to the factors which affect the precision of its measurement including those arising from the absorbers, those arising from the x-ray spectrometer's resolution in energy, and those arising from the detection of the x-ray beam. (auth)

11978 AFOSR-TN-58-476

Stanford Univ., Calif.

SUM RULES FOR INELASTIC ELECTRON SCATTERING. Technical Report No. 32. S. D. Drell and C. L. Schwartz. June 1958. 39p. Project No. 3750-37504. Contract AF18(600)-545. (AD-158287).

Sum rules were constructed for the analysis of inelastic electron scattering at about 150 Mev from light nuclei, taking into account the effects of nucleon charge, recoil, magnetic-moment currents, exchange currents, finite nucleon size, nuclear center-of-mass motion, kinematical factors of correct relation between initial and final electron energies, the scattering angle, and the nuclear excitation energy. (auth)

11979 CWR-444

Curtiss-Wright Corp. Research Div., Quehanna, Penna.

INELASTIC SCATTERING OF FAST NEUTRONS BY Fe^{56}, 0.5 MEV $\leq E_n \leq$ 5.0 MEV. C. E. Mandeville. Nov. 1956. 38p. Contract AT(30-3)-220. $6.30(ph) OTS); $3.00(mf OTS).

A short review of the probability and dynamics of nuclear collisions is presented. The level scheme for Fe^{56} is derived from the neutron groups resulting from scattering, elastic and inelastic, of neutrons or various energies. Only the energy limits of the neutron groups were calculated and an isotropic emission was assumed. (W.D.M.)

11980 CWR-459

Curtiss-Wright Corp. Research Div., Quehanna, Penna.

INELASTIC SCATTERING OF FAST NEUTRONS BY Fe^{56}, 5.0 MEV $\leq E_n \leq$ 10.0 MEV. C. E. Mandeville. Feb. 1957. 47p. Contract AT(30-3)-220. $7.80(ph OTS); $3.30(mf OTS).

The energy distributions of inelastically scattered 5- to 10-Mev neutrons were calculated using the statistical model of the nucleus. The energy limits and cross sections of elastically scattered neutrons by Fe^{56} are given. (W.D.M.)

11981

THEORY OF THE SCATTERING OPERATOR. J. M. Jauch (State Univ. of Iowa, Iowa City). Helv. Phys. Acta 31, 127-58(1958).

A complete theory of the scattering operator is given on a rigorous mathematical foundation for a certain class of quantum mechanical systems called, 'simple scattering systems.' These systems are characterized by three properties. The relation of these properties to the physical content of scattering is explained. The wave operator and the scattering operator are defined and their existence proven with mathematically rigorous methods. No assumptions are needed regarding the occurrence of bound states and the location of their energy with respect to the continuum region of the total energy operator. The existence of a certain integral representation of the scattering operator which has often been used as a starting point of the iteration approximation is demonstrated. Certain general properties of scattering systems are obtained. This leads to necessary conditions for systems to be scattering systems as well as to a new definition of the scattering operator. The paper concludes with a derivation of the scattering cross-section from the scattering operator. The improvement of this derivation over the older ones consists in the special care employed for stating the assumptions which must go into such a derivation and the avoidance of improper functions or other artificial devices. (auth)

11982

DETERMINATION OF X-RAY ABSORPTION COEFFICIENTS OF INHOMOGENEOUS MATERIALS. Sabri Ergun and Victor H. Tiensuu (Bureau of Mines, Region V, Pittsburgh 13, Penna.). J. Appl. Phys. 29, 946-9 (1958) June.

A method was developed for determining x-ray absorption coefficients of inhomogeneous materials. It involves comparison of the reflected and transmitted intensities from the same specimen at various scattering angles. The difference in the geometry of the reflection and transmission techniques permits calculation of the absorption coefficient from the observed intensities. Evaluation of the absorption coefficient at different angles overcomes the uncertainties of the conventional method caused by small angle scattering, white radiation, crystalline mineral impurities, etc., and eliminates the necessity of measuring the intensity of the primary

beam. The method is not limited to x rays; it is equally applicable to γ rays, neutrons, and visible light. (auth)

11983

ON NON-UNIQUENESS OF NUCLEON-NUCLEON SCATTERING PHASE SHIFTS. L. G. Zastavenko, R. M. Ryndin, and Chou Kuang-Chao (Joint Inst. of Nuclear Research, Dubna, USSR). Nuclear Phys. 6, 669-71(1958) May.

The cross section for scattering of mesons by nucleons does not change upon application of the phase-shift substitution proposed by Minami. The two phase-shift sets which are obtained from each other by means of the substitution can be differentiated either by carrying out polarization experiments or by studying the energy dependence of the cross section at small energies. Similar transformations for nucleon-nucleon scattering are derived. (A. C.)

11984

ATTENUATION OF γ-RAYS FROM AN INFINITE PLANE. M. G. Chasanov and M. Shatzkes (IBM Corp., Oswego, N. Y.). Nucleonics 16, No. 6, 63(1958) June.

For an infinite plane source of gamma rays the attenuation factor ϕ/ϕ_0 is given by $\frac{1}{2}$ [e^{-b} + $E_1(b)$]. A solution for the equation for elements other than lead and for gamma energies to 3 Mev is given in the form of a nomogram. (W.D.M.)

11985

PROTON-PROTON COLLISION IN HIGH ENERGY. D. Ito (Tokyo Univ. of Education); S. Minami (Osaka City Univ.); and H. Tanaka (Univ. of Bologna). Nuovo cimento (10) 8, 135-46(1958) Apr. 1.

The experimental results of the proton-proton collisions at 1.5 and 2.75 Bev by Fowler et al. are analyzed in a phenomenological way. It is found then that the partial waves of l = 2 to 5 and l = 2 to 7 are mainly responsible for the pion production at 1.5 and 2.75 Bev, respectively. Further, from analysis in such an energy region it is shown that the effective size of the proton is nearly constant ($(0.6 \text{ to } 9.7) \times 10^{-13}$ cm). (auth)

11986

THE RANGE-ENERGY RELATION IN EMULSION. PART I. RANGE MEASUREMENTS. W. H. Barkas, P. H. Barrett, P. Cüer, H. Heckman, F. M. Smith, and H. K. Ticho (Univ. of California, Berkeley). Nuovo cimento (10) 8, 185-200(1958) Apr. 16.

Simultaneous exposures have been made of Ilford G.5 emulsion to magnetically analyzed mesons as well as to hydrogen and helium nuclei of various velocities. Measurements of the particle ranges have been made for equivalent proton energies of 1.295 Mev to 700 Mev. Individual particle momenta were known to better than one part in a thousand. Especial care was taken to maintain the emulsion density at an accurately measured value. Curves and formulas used for converting particle ranges to their proton equivalents at other emulsion densities are given. Detailed procedures for correcting ranges of particles that traverse gaps between pellicles are described. Various effects that influence range measurements are discussed. Comparisons with existing data are made. Good agreement is found to exist only when the emulsion densities are known, and a correct procedure is employed to adjust the measured ranges to standard conditions. An empirical correction of the Vigneron range table is made. (auth)

11987

THE RANGE-ENERGY RELATION IN EMULSION. PART II. THE THEORETICAL RANGE. W. H. Barkas (Univ. of California, Berkeley). Nuovo cimento (10) 8, 201-14(1958) Apr. 16.

The Bethe-Bloch theory of stopping, including shell corrections and the density-effect correction, is used to calculate theoretical ranges for standard Ilford G.5 emulsion. Only the mean ionization potential is an adjustable parameter. Making corrections for the K shells of all emulsion atoms except hydrogen, and also correcting for the L shells of iodine, silver, and bromine, one can obtain a fit to the measured ranges for protons of 1 to 700 Mev. The mean ionization potential found is (331 ± 6) ev, and I/Z has a value of (12.1 ± 0.2) ev as an average for all emulsion elements except hydrogen. At low velocities the hydrogenlike atomic model used in the shell-correction calculations appears to over-accentuate the shell effects. A better agreement with the experimental data for proton energies below 40 Mev is obtained semiempirically. A range table for emulsion of standard density is given. A calculated range table for water, useful for adjusting ranges measured under non-standard density conditions, is also included. (auth)

11988

STUDY OF THE ABSORPTION OF K^- MESONS AT REST IN NUCLEAR EMULSIONS. G. L. Bacchella, A. Berthelot, A. Bonetti, O. Goussu, F. Lévy, M. René, D. Revel, J. Sacton, L. Scarsi, G. Tagliaferri, and G. Vanderhaeghe (Univ. of Milan). Nuovo cimento (10) 8, 215-46(1958) Apr. 16. (In French)

The results of the analysis of 391 events of K^- absorption at rest in a large emulsion stack exposed to the Berkeley Bevatron are reported. Scanning "along the track" was used, in order to obtain unbiassed frequencies for the various types of particles. A detailed discussion of the identification of charged hyperons is presented. The findings of previous workers on the features of the observed $\Sigma^{\pm}\pi^{\mp}$ pairs, and their respective rates of observation, are confirmed. Three absorptions on free protons were observed. Several examples of fast Σ-hyperons unaccompanied by charged π's provide direct evidence for two-nucleon absorptions: they account for ~25% of the total number of events. Direct production of Λ^0-hyperons is inferred from the observation of fast π-mesons; in addition, hyperfragments associated with 3% of the events indicate production of Λ^0's either directly or via decay or interaction of Σ's. Among the pions whose sign was recognized (40% of the total), the negative ones were found to be more frequent than the positive by a factor of about 3. Evidence for the nuclear reabsorption of hyperons and pions is provided by the study of the visible energy release associated with the absorptions. Some 60% of the events do not contain charged unstable particles: a fair number (~17%) of these events are accompanied by protons of kinetic energy greater than 60 Mev, a fact which suggests the intervention of two-nucleon reactions. (auth)

11989

SEMICLASSICAL LIMIT FOR EXCITATION OF ROTATIONAL MOTION BY SCATTERING. David M. Chase (TRG, Inc., New York). Phys. Rev. 110, 673-5(1958) May 1.

The problem of scattering of particles by a quantum-mechanical symmetric top, with an interaction consisting of a potential well symmetric about the figure axis, is studied in an approximation in which the motion of the top is treated classically. The time-modulated adiabatic elastic scattering amplitude is Fourier analyzed, and the components are associated with rotational excitations. Cross sections, averaged over the azimuth of the target angular momentum, are directly comparable with results from the quantum-mechanical adiabatic approximation. Exact correspondence is found in the

envisaged limit by virtue of a limiting form for Clebsch-Gordon coefficients. A similar limiting form is given for Racah coefficients. (auth)

11990

ELASTIC AND INELASTIC SCATTERING OF 18-Mev ALPHA PARTICLES FROM NEON, ARGON, AND XENON. L. Seidlitz, E. Bleuler, and D. J. Tendam (Purdue Univ., Lafayette, Ind.). Phys. Rev. 110, 682-91(1958) May 1.

The scattering of 18-Mev alpha particles from neon, argon, and xenon was studied with a multiplate reaction chamber. The scattered particles were defined within an rms angular width of 0.45° by a system of slit pairs, spaced every $2\frac{1}{2}°$ from 10° to 170°. The elastic scattering from neon and argon show the pronounced maxima and minima characteristic of diffraction scattering but are equidistant in ϕ, not sin $(\phi/2)$. The ratio to Rutherford scattering varies as much as 25-fold between successive maxima and minima in the case of neon, the well-defined structure indicating a small mean free path for absorption of alpha particles in the nucleus. Nuclear interaction radii calculated by the formula $2kR\Delta[\sin(\phi/)] = \pi$ were found to be 6.36×10^{-13} cm for neon and 6.95×10^{-13} cm for argon. Xenon, investigated chiefly for control purposes, showed no definite deviation from Rutherford scattering up to 50°. Groups corresponding to the excitation of the 1.63-, 4.25-, 4.97-, 5.81(5.63)-, and 7.2-Mev levels of Ne^{20} and the 1.46-Mev level of Ar^{40} were observed. No excited states were observed in xenon. Notably absent was excitation of the 6.74-Mev (0^+) level in Ne^{20}. As predicted by direct-interaction theories, the cross sections for inelastic scattering leading to the first excited (2^+) states of neon and argon could be approximated by the squares of spherical Bessel functions of the second order with interaction radii of 6.71×10^{-13} cm for neon 6.60×10^{-13} cm for argon. These cross sections do not tend toward small values in the forward direction, which is interpreted as evidence for distortion of the incident and scattered waves. No fit was possible for any of the other excited states. (auth)

11991

SCATTERING OF 25-87 Mev PHOTONS BY PROTONS. C. L. Oxley (Univ. of Chicago). Phys. Rev. 110, 733-7 (1958) May 1.

Scattering of 87-Mev bremsstrahlung by liquid hydrogen has been measured with a lead converter-telescope arrangement at angles from 70 to 150 degrees. The weighting function of the cross-section peaks at 60 Mev, has a full width of 55 Mev, and is approximately symmetrical. In this angular range contributions from processes other than elastic scattering from protons are believed to be small. The observed cross sections are somewhat smaller and flatter in angular distribution than those given by Powell's formula for scattering by a point proton with the static anomalous moment. (auth)

11992

THEORETICAL ANGULAR DISTRIBUTION OF NUCLEON-ANTINUCLEON SCATTERING AT 140 Mev. Jose R. Fulco (Univ. of California, Berkeley). Phys. Rev. 110, 784-5(1958) May 1.

A possible explanation of the large value of the nucleon-antinucleon cross section, in the intermediate energy ranges, has been given by the work of Ball and Chew on the basis of the Yukawa interaction. Using the Gartenhaus potential, with the spin-orbit term added by Signell and Marshack, in the WKB approximation, they obtained results in satisfactory agreement with the experimental data available at that time. Recent experiments with bubble chambers and with emulsions have been planned and are now being carried out in order to obtain a more complete knowledge of the p-p interaction. In connection with this program calculations are reported of the angular distribution of antinucleon-nucleon scattering, using the transmission coefficients and the phase shifts given by Ball and Chew. (A.C.)

11993

BETA-GAMMA CORRELATIONS FROM POLARIZED MANGANESE-52. E. Ambler, R. W. Hayward, D. D. Hoppes, and R. P. Hudson (National Bureau of Standards, Washington). Phys. Rev. 110, 787-9(1958) May 1.

A recent calculation by Curtis and Lewis and by Morita and Morita gives a distinction and correlation function for the beta and subsequent gamma radiations from oriented nuclei in a j-j beta transition. An experimental determination of the parametric in this function can give information on the magnitude and relative phase of the Fermi and Gamow-Teller interactions involved. Such experimental determinations on polarized Mn^{52} have been made. In order to evaluate each parameter uniquely, certain assumptions must be made about the nature of the beta interactions. The recent experiments on Ar^{35} and Ne^{19} and the balanced recoil experiment on Eu^{152} using resonance fluorescence techniques, together with the reevaluation of the He^6 recoil experiment, indicate that vector and axial vector are the predominant forms of the Fermi and Gamow-Teller interactions, respectively. Furthermore nearly all of the recent experiments measuring the longitudinal polarization of electrons and positrons and also their angular distribution in beta decay are in accord with the two-component neutrino hypothesis where neutrinos of negative helicity are emitted in both Fermi and Gamow-Teller decays. (A.C.)

11994

SCATTERING OF GAMMA RAYS BY A STATIC ELECTRIC FIELD. A. M. Bernstein and A. K. Mann (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 110, 805-14 (1958) May 15.

In an effort to observe Delbrück scattering the absolute differential cross sections for the elastic scattering of 1.33-Mev gamma rays by lead, tin, and uranium and of 2.62-Mev gamma rays by lead and tin have been measured for angles between 15 and 105 degrees. The observed scattering is the coherent sum of Delbrück, Rayleigh, and nuclear Thomson scattering. The amplitude for the latter process is well known; recent calculations of Rayleigh scattering, which are in good agreement with data obtained previously in this laboratory for gamma-ray energies below 1 Mev, provide exact values of the amplitudes at 1.33 Mev and approximate values at 2.62 Mev. At 1.33 Mev, the difference between the observed scattering and that due to the Rayleigh and Thomson processes is not sufficiently large compared with experimental error to permit a definite identification of Delbrück scattering to be made. At 2.62 Mev, for lead, the experimental cross sections at intermediate angles (30 to 75 degrees) are substantially larger than those calculated by extrapolation of the exact calculations, even when reasonable allowance for error in the extrapolation is made. The most probable explanation for this difference is an appreciable contribution from Delbrück scattering. (auth)

11995

BREMSSTRAHLUNG OF VERY LOW-ENERGY QUANTA IN ELEMENTARY PARTICLE COLLISIONS. F. E. Low (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 110, 974-7(1958) May 15.

It is shown that the first two terms in the series expansion of the differential bremsstrahlung cross section (in powers of the energy loss) may be calculated exactly in terms of the corresponding elastic amplitude and the electromagnetic constants of the participating particles. (auth)

11996

$\bar{p}$-p ELASTIC AND CHARGE EXCHANGE SCATTERING AT ABOUT 120 Mev. L. Agnew, T. Elioff, W. B. Fowler, L. Gilly, R. Lander, L. Oswald, W. Powell, E. Segrè, H. Steiner, H. White, C. Wiegand, and T. Ypsilantis (Univ. of California, Berkeley). Phys. Rev. 110, 994-5(1958) May 15.

Observation of antiproton–proton collisions in a propane bubble chamber at an average energy of 120 Mev has been accomplished. The ratio of antiprotons to other particles in the beam has been increased by utilizing the differential rate of momentum loss in absorbers between antiprotons and other particles. The angular distribution of 33 $\bar{p}$-p scattering events between 15 and 165° c.m. is presented. (W.D.M.)

11997

RANGE OF 14-Mev PROTONS IN NUCLEAR EMULSION. F. C. Gilbert, H. E. Heckman, and F. M. Smith (Univ. of California, Berkeley). Rev. Sci. Instr. 29, 404-5(1958) May.

Neutrons, produced by the reaction $H^3(d,n)He^4$, gave proton recoils in nuclear emulsion whose ranges were used to obtain a calibration point on the range–energy relation. The range for 13.94 ± 0.10-Mev protons in emulsion of density 3.815 g/cm^3 is 995.9 ± 2.1 μ. (auth)

11998

ENERGY AND ANGULAR DISTRIBUTIONS OF FAST PHOTOPROTONS FROM Ni AND Al. E. B. Bazhanov, Yu. M. Volkov, A. P. Komar, L. A. Kul'chitskii, and V. P. Chizhov (Leningrad Physico-Tech. Inst., Academy of Sciences, USSR). Soviet Phys. (Doklady) 2, 107-9(1957) Mar.–Apr.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 8204.

11999

ON THE GREEN'S FUNCTION IN THE THEORY OF RADIANT ENERGY TRANSFER. B. B. Kadomtsev. Soviet Phys. (Doklady) 2, 139-42(1957) Mar.–Apr.

An equation is derived which shows that Green's function satisfies the conjugate equation for a point source with the conjugate boundary conditions. The conjugate equation can be used successfully in problems where it is required to determine some properties of the radiation as a function of the parameters of a point source. It is shown how the intensity of radiation in only a part of the medium bounded by some surface S_1 may be determined. (J.S.R.)

12000

PASSAGE OF VARIOUS GAS IONS THROUGH A THIN SILVER FOIL. V. G. Tel'kovskii and V. I. Pistunovich. Soviet Phys. (Doklady) 2, 184-6(1957) Mar.–Apr.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 10145.

12001

MOTT SCATTERING IN SCATTERING FOILS OF FINITE THICKNESS. H. Wegener (Univ. of Erlangen, Germany). Z. Physik 151, 252-63(1958). (In German)

Transverse polarized electrons were scattered on a thin foil. The scattering probability was developed according to the foil thickness d and the d^2 term of the probability equation was calculated as a function of the electron energy $\beta = v/c$, of the scattering angle δ_s, and of the polarization degree P. The d^2 term contains the severe perturbations attainable in the scattering tests and the polarization measurements through small angle and multiple scattering. The results, using gold as the scattering foil, are tabulated for $0.4 \leq \beta \leq 0.8$ and $60° \leq \delta_s \leq 120°$. These calculations were carried out with respect to the electron polarization in beta decay. (tr-auth)

12002

INVESTIGATION OF MULTIPLE SCATTERING OF PROTONS. F. R. Arutyunyan (Inst. of Physics, Academy of Sciences, Armenian SSR.). Zhur. Eksptl'. i Teoret. Fiz. 34, 800-6(1958) Apr. (In Russian)

Multiple scattering of protons with energies from 90 to 200 Mev and with energies from 40 to 60 Mev was investigated respectively in lead and copper plates of various thicknesses. The experimental data are compared with the multiple Coulomb scattering curves for a point and extended nucleus. The experimental results exceed the theoretical values for a finite size nucleus. The effect of nuclear scattering depends on the relation between the angle $\theta = \lambda\!\!\!^{-}/R$ and the mean square angle of multiple Coulomb scattering. The integral cross section for nuclear scattering of protons $\sigma = (0.0755 \pm 0.0375)\ \sigma_{geom}$ were obtained in the angle region in which Coulomb scattering is small compared with nuclear scattering. This value is in good agreement with the optical model of an "absolutely black" nucleus. (tr-auth)

12003

YIELD OF ELECTRONS EMITTED UNDER THE ACTION OF γ-RAYS. M. V. Chatskevich and E. M. Center. Zhur. Eksptl'. i Teoret. Fiz. 34, 807-10(1958) Apr. (In Russian)

The absolute yield of electrons from aluminum target of effective thickness produced by 2.62 Mev γ quanta is determined experimentally and computed theoretically. (tr-auth)

12004

MONTE-CARLO CALCULATION OF AN ELECTRON-PHOTON CASCADE IN LEAD. V. V. Chavchanidze, R. S. Shaduri, and V. A. Kumsishvili (Inst. of Physics, Academy of Sciences, Georgian SSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 912-15(1958) Apr. (In Russian)

A statistical-probability method for modeling an electron-photon cascade (in lead) initiated by a γ-quantum is proposed which is based on the method of random tests (a modification of the Monte-Carlo method). Some typical curves computed in this fashion are presented. Two methods of performing similar computations with the aid of existing electronic computers are indicated. (tr-auth)

12005

SCATTERING OF PARTICLES WITH ARBITRARY SPINS. L. D. Puzikov (Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 947-52(1958) Apr. (In Russian)

Geometrical consequences regarding scattering which follow from the fact that nuclear particles possess spins are considered. A scattering matrix for particle with an arbitrary spin is constructed. Quantities which can be experimentally measured, such as cross section, polarization, correlation of polarizations etc. are expressed in terms of this matrix. The extent to which the polarization experiment is sufficient is examined and it is shown that in order to reconstruct the scattering matrix one must either measure the scattering cross section of a polarized beam on a polarized target

or the polarization correlation after scattering (the initial state being an unpolarized one) or else, the change in polarization of the incident particles occurring during scattering (multiple scattering); the latter experiments will suffice if the spin of the beam is not smaller than that of the target. (tr-auth)

12006

RELAXATION OF DEUTERIUM NUCLEI IN PARAMAGNETIC SOLUTIONS. A. I. Rivkind (Inst. of Physics in Tech., Kazan Branch of the Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 1007-9(1958) Apr. (In Russian)

Studies were made of the magnetic spin relaxation of deuterons in heavy water solutions of Cr^{3+}, Mn^{2+}, Fe^{3+}, and Cu^{2+} salts. A modified method was used in measuring the saturation curves in which the degree of nuclear saturation varies with the concentration of paramagnetic ions in the solution. The experiments were made at room temperature with a field oscillation frequency ν_0 = 2.6 M herts/sec. (R.V.J.)

12007

ON THE ELASTIC SCATTERING OF HIGH ENERGY PARTICLES ON DEUTERONS. A. A. Rukhadze. Zhur. Eksptl'. i Teoret. Fiz. 34, 1014-15(1958) Apr. (In Russian)

The elastic scattering of protons on deuterons at 675 Mev is evaluated by means of the deuteron wave function. (R.V.J.)

12008

SCATTERING OF DEUTERONS ON DEUTERIUM AND TRITIUM AT SMALL ENERGIES. Yu. G. Balashko and I. Ya. Barit (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 1034-6(1958) Apr. (In Russian)

The cross section of d – t scattering at 90° in the energy interval 30 to 300 kev (central mass system) and the cross sections of 100 to 600 kev deuteron scattering on deuterium at 67° angle in central mass system were measured. A tabulated analysis of the obtained data is presented. The relation of the measured cross sections to the effective cross section of scattering by the Coulomb field is indicated for both cases. (R.V.J.)

Radiation Effects

Refer also to abstract 11405.

12009 NARF-58-1T(Add. 2)

Convair, Fort Worth, Tex.

RESULTS OF SYSTEM PANELS TEST NUMBER 2. ADDENDUM 2. Jan. 6, 1958. 143p. Project 6(1-9964). Contract AF33(600)-32054. (FZK-9-126-2).

During the SPT-2 tests at Convair, Forth Worth, Texas a J-79 Aircraft Engine was exposed to radiation from the ground test Reactor. Using foil measurement techniques, the neutron flux and energy spectrum incident on the engine were determined. The resulting induced radioactivity was determined by measurement and plotting of the decay gamma emission from the engine and several of the important active isotopes produced have been identified. Decay curves have been extrapolated for other times of reactor operation, and decay gamma isodose curves plotted for various times after reactor shutdown. (auth)

12010 NOLC-374

Naval Ordnance Lab., Corona, Calif.

PERFORMANCE OF SOLID STATE MATERIALS AND DEVICES SUBJECT TO A NUCLEAR RADIATION FLUX. H. H. Wieder. Aug. 6, 1957. 29p. (NAVORD-4621; AD-143467).

Solid-state materials and components have been evaluated with respect to changes in their electrical characteristics brought about by a nuclear radiation flux. The effects of nuclear radiation are strongest when the physical properties of the solid depend upon large scale order in the crystalline lattice or when the type, quantity, and arrangement of impurities within the solid are of prime importance. Calculations indicate that the radiation flux to be expected from a reactor used for powering a large missile or airplane would be on the order of and probably less than 10^{11} neutrons/cm^2. Most solid-state devices and materials perform satisfactorily at this dosage. In general, metals, dielectrics, piezoelectrics, and ferroelectrics show only small radiation damage for dosages below 10^{15} neutrons/cm^2. Semiconductors, however, are affected strongly by neutron- and γ-flux fields. Silicon withstands radiation up to 10^{16} neutrons/cm^2; germanium shows no radiation damage to 10^{12} neutrons/cm^2. Ionic type semiconductors have a radiation sensitivity intermediate between germanium and silicon. Tests on solid-state components verify the measurements made on constituent materials. Little effect is noted upon capacitors, resistors, inductors, and vacuum tubes for flux values below 10^{15} neutrons/cm^2. In cases of semiconductor diodes and transistors, additional effects such as photo EMFs, photoconductivity, and noise must be considered. Some of these are transient and last only for the duration of the irradiation. Permanent radiation damage occurs at approximately the same dosage level as that indicated above for semiconductor material. (auth)

12011 NP-6786

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

MONTHLY ACCESSION LIST NO. 12 [ON RADIATION EFFECTS DATA]. June 15, 1958. 19p. Project No. 2133. Contract AF33(616)-5171.

A compilation of articles which, in most cases, have been abstracted is presented. The list is divided into articles concerning: general background, electrical and electronic systems, polymeric materials, fuels, lubricants and hydraulic fluids, ceramic materials, metals and alloys, inorganic chemicals, organic chemicals, facilities, experimental techniques, and a miscellaneous section. (J.R.D.)

12012

NEUTRON INDUCED NUCLEAR REACTIONS IN SOLIDS RESULTING IN GAS FORMATION. R. S. Barnes and G. B. Redding (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Atomics and Nuclear Energy 9, 166-7, 184(1958) May.

Many materials, when submitted to irradiation by neutrons in a nuclear reactor, give rise to gaseous products. At elevated temperatures the gas molecules may give rise to damage in the solid. (auth)

12013

DISLOCATIONS, POINT-DEFECT CLUSTERS, AND CAVITIES IN NEUTRON IRRADIATED LiF CRYSTALS. J. J. Gilman and W. G. Johnston (General Electric Research Lab., Schenectady, N. Y.). J. Appl. Phys. 29, 877-88(1958) June.

Micrographic techniques were used to study dislocations, point defect clusters, and cavities in neutron-irradiated LiF crystals. No evidence of inhomogeneous damage caused by "thermal or displacement spikes" was found. However, a uniform etching effect was found for doses greater than ~ 10^{15} nvt. The etching is be-

lieved to be caused by clusters of point defects greater than 2 but less than 50 A in size. This agrees with previous x-ray results. The defect clusters decrease in number and increase in size with increasing annealing temperatures. At temperatures greater than ~400°C only (110) dislocation loops remain and these disappear above ~600°C. Electron bombardment causes a similar effect. The as-grown dislocation structure of LiF is not affected by neutron bombardment. However, it becomes increasingly difficult to move fresh dislocations in crystals given neutron doses greater than $\sim 10^{12}$ nvt. The hardening is independent of dislocation velocity and temperature and hence cannot be caused by Cottrell-pinning of dislocations. The color changes that accompany hardening suggest that it is caused by defect clusters rather than single defects. At annealing temperatures above ~600°C crystallographic cavities appear in LiF crystals. They are rectangular parallelepipeds with (100) sides. Evidence is presented to show that the cavities are not caused by fission gases but probably by loss of fluorine from the crystals. (auth)

12014

STUDY OF ORDER IN ANNEALED AND IRRADIATED ALPHA BRASS BY LATTICE PARAMETER MEASUREMENTS. R. Feder, A. S. Nowick, and D. B. Rosenblatt (Frankford Arsenal, Philadelphia). J. Appl. Phys. 29, 984-8(1958) June.

The increase in short-range order in alpha brass (25 and 30% Zn) produced by thermal treatment or neutron irradiation is accompanied by a measurable decrease in lattice parameter (up to 0.02%). The equilibrium values of the lattice parameter decrease markedly with annealing temperature in the lower range of the measurements, i.e., in the vicinity of 125°C. The activation energies calculated from the kinetics of the lattice parameter changes are 40.7 kcal/mole for the 25% Zn alloy, and 39.5 kcal/mole for the 30% Zn alloy, in agreement with results of anelastic measurements and electrical resistivity studies. From thermodynamic data it is estimated that a decrease in lattice parameter of 0.01% corresponds to an increase of about 0.05 in the Bethe short range order parameter. (auth)

12015

IRRADIATION DAMAGE AND RECOVERY IN MOLYBDENUM AND TUNGSTEN. G. E. Kinchin and M. W. Thompson (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nuclear Energy 6, 275-84 (1958) May.

Specimens of molybdenum and tungsten were irradiated with pile neutrons at 30°C and at −196°C. The recovery of the increase in resistivity was studied and processes were observed with activation energies of 0.25 0.25 and 1.3 ev for molybdenum and with 0.5 and 1.7 ev for tungsten. A stored energy release of 0.4 cal/g from 50 to 250°C was also observed from molybdenum irradiated with 1.3×10^{19} n/cm^2. (auth)

12016

NUCLEATION OF BUBBLES IN SUPERHEATED AQUEOUS SOLUTIONS BY FAST PARTICLES. John A. Ghormley (Oak Ridge National Lab., Tenn.). J. Nuclear Energy 6, 300-2(1958) May.

Energy loss along the track of a fission recoil or α-particle in superheated uranyl sulfate solution or the recoil from a fast-neutron collision in superheated ether can account for evaporation of sufficient liquid to form bubble nuclei under conditions where nucleation is observed. The contribution of charge repulsion cannot be determined from experimental results. (auth)

12017

FULL-SCALE TURBOJET ACTIVATION EXPERIMENT PRELIMINARY RESULTS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 124, Session 13. J. Moteff (General Electric Co.). New York, American Institute of Chemical Engineers, 1958. 21p.

In an effort to obtain full-scale experimental data on induced activity, a standard production-line J47 turbojet was irradiated at the Tower Shielding Facility in Oak Ridge. The selected engine was a J47 Model E. Preliminary results indicate that the activity to about one day after exposure is due to manganese. From one to about 500 days the tantalum activity dominates for a contact dose. Finally beyond 500 days after exposure the cobalt activity is the sole contributor. The importance of geometry on radiation levels is demonstrated in this experiment. It is especially acute when trying to determine a contact dose, which may be a highly localized effect, when only an isodose pattern about the engine exists. (auth)

12018

PIPE THICKNESSES WHICH MINIMIZE STRESSES DUE TO INTERNAL PRESSURE AND GAMMA HEATING. K. R. Merckx (General Electric Co., Richland, Wash.). Nuclear Sci. and Eng. 3, 774-7(1958) June.

Values of pipe thickness which minimize the total stress in a tube which is internally cooled and under internal pressure from uniform gamma heating are presented. Total stress values as well as the contributions due to the pressure and temperature gradient are given. The properties of various piping materials which are useful for these calculations are listed. (W.D.M.)

12019

RADIATION EFFECTS IN MAGNETIC MATERIALS. D. I. Gordon, R. S. Sery, and R. E. Fischell (U. S. Naval Ordnance Lab., White Oak, Silver Spring, Md.). Nucleonics 16, No. 6, 73-7(1958) June.

Magnetic property changes induced by reactor radiation of seven commercial magnetic materials were measured. Almost all samples show deterioration in their magnetic properties, but magnitudes of effects vary considerably from one material to another. (W.D.M.)

12020

THE PROBLEM OF RADIATION INFLUENCE OF SOLID BODIES. K. Lintner and E. Schmid (Univ. of Vienna). Nukleonik 1, 29-40(1958) Apr.

A survey is given of the effects of corpuscular radiation on the properties of crystalline substances. 53 references. (J.S.R.)

12021

DISCRETE RECOVERY SPECTRUM BELOW 65°K IN IRRADIATED COPPER. J. W. Corbett and R. M. Walker (General Electric Research Lab., Schenectady, N. Y.). Phys. Rev. 110, 767-8(1958) May 1.

An experiment on electron-irradiated copper is reported which demonstrates directly, independent of analysis, that at least four regions of recovery exist in the temperature range 20 to 80°K. The sample was held at ~20°K during irradiation and was bombarded with 1.4-Mev electrons. The total radiation-induced resistivity increment was 2.99×10^{-10} ohm cm which corresponded to 2×10^{-4} atomic concentration of defects based on a value of 1.45 micro-ohm cm per atomic percent Frenkel pairs. The similar structure observed in both the deuteron and electron experiments suggested that the discrete recovery stages are due to intrinsic processes and are not associated with chemical impurities. (A.C.)

12022

LUMINESCENCE FROM X-RAY COLORED KBr CRYSTALS DURING PLASTIC DEFORMATION. H. R. Leider (Univ. of California, Livermore). Phys. Rev. 110, 990-1(1958) May 15.

The spectral distribution of the luminescence, produced by compressing irradiated potassium bromide crystals, from 2000 to 9000 A, was determined. The emission spectrum is presented. (W.D.M.)

12023

EVIDENCE FOR INTERSTITIALS IN LOW-TEMPERATURE X-RAY IRRADIATED LiF. D. A. Wiegand and R. Smoluchowski (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 110, 991-2(1958) May 15.

By a modification of the photoelastic technique, the volume expansion and annealing of x-ray-irradiated LiF has been studied. One half of a thin plate is irradiated normal to the plate while the other half is shielded. The constraint placed upon the irradiated half of the crystal by the unirradiated portion at the boundary hampers the expansion of the irradiated half and so introduces strain into both halves. The crystal then becomes birefringent, and the strain pattern can be analyzed with polarized light. (W.D.M.)

Radioactivity

12024 HW-53710

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

NATURAL RADIOACTIVITY. M. W. McConiga. Nov. 22, 1957. 16p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

Natural radioactivity in air, ground, cosmic radiation, drinking water, and food is discussed in relation to dosage received by man. (T.R.H.)

12025

ANGULAR CORRELATION MEASUREMENTS ON Cu^{65}. Britt Hartmann and Inger Asplund (Univ. of Stockholm). Arkiv Fysik 13, 339-45(1958).

The angular correlation of the two cascaded γ rays of energies 0.38 and 1.11 Mev in Cu^{65} has been studied with scintillation spectrometers. The coefficients of the Legendre expansion $W(\theta) = 1 + A_2P_2 + A_4P_4$ of the coincidence distribution function have been determined. (auth)

12026

SOME FEATURES OF THE DECAY OF Au^{198} TO Hg^{198} Gunnar Bäckström and Olov Bergman (Inst. of Physics, Uppsala). Arkiv Fysik 13, 393-7(1958).

Hg^{198} is found to emit gamma rays of energies 0.67575 and 1.0875 Mev in decaying from its second excited state. A splitting of this state, which has recently been reported elsewhere, is not observed. The β branching to a state at 1.000 Mev, observed in the decay of Tl^{198m}, is shown to be weaker than theoretically expected. The results are discussed. (auth)

12027

β-DECAY MATRIX ELEMENTS IN STRONGLY DEFORMED NUCLEI. Gaja Alaga (Faculty of Science, Zagreb). Glasnik mat.-fiz. i Astron. Ser. II, 12, 245-6 (1957).

The beta spectra, half lives, and electron neutrino angular correlations are calculated by the perturbation method. The nuclear matrix elements are treated as parameters. (R.V.J.)

12028

$^{90}Sr-^{90}Y$ BETA-RAY APPLICATOR CALIBRATION. Richard I. Weller (Brookhaven National Lab., Upton, N. Y.). J. Nuclear Energy 6, 331-7(1958) May.

A 125 mc $Sr^{90} + Y^{90}$ beta applicator was calibrated with an extrapolation ionization chamber and by the use of nuclear film. Surface and depth doses determined by the two methods were in good agreement. Using a polystyrene phantom, the surface dose was found to be 26.2 e.s.u./cm^3 sec, or 1430 r/min, with an estimated accuracy of ± 3%. The half-value thickness was determined to be 0.13 cm. (auth)

12029

ON THE GAMMA SPECTRA OF Ag^{110}, Sb^{124} AND $Eu^{152,154}$. B. S. Dzelepow and N. N. Zhukovsky (V. G. Khlopin Radium Inst., USSR Academy of Sciences, Leningrad). Nuclear Phys. 6, 655-68(1958) May.

The elotron, a recoil electron gamma spectrometer with improved focusing properties, was used to study the gamma radiation from Ag^{110}, Sb^{124}, and $Eu^{152,154}$. (auth)

12030

ENERGY RELEASE FROM THE DECAY OF FISSION PRODUCTS. J. F. Perkins (Lockheed Aircraft Corp., Marietta, Ga.) and R. W. King (Purdue Univ., Lafayette, Ind.). Nuclear Sci. and Eng. 3, 726-46(1958) June.

The total disintegration rates, rates of beta- and gamma-energy release, and gamma-ray energy spectrum, are calculated for fission products due to thermal neutron fission of U^{235}. Reactor operating times of 1, 10, 100, and 1000 hours are treated, and the results plotted for decay times ranging from 10^2 to 10^8 seconds. In addition, results for instantaneous operation are compared to other calculations and measurements. The present results fall below Way and Wigner's predictions of both disintegration rate and total energy release over the entire range of decay times, though they agree satisfactorily with the Way-Wigner rule-of-thumb expressions. The present results are in very good agreement with experimental measurements. The gamma spectrum is found to vary considerably with decay time but to be only a weak function of reactor operating time. The total beta and antineutrino energies per fission are found to be 7.6 ± 0.5 and 10.0 ± 0.7, respectively. (auth)

12031

ON THE "INTERNAL BREMSSTRAHLUNG" ASSOCIATED WITH THE BETA DECAY OF $_{81}Tl^{204}$. R. A. Ricci (Istituto di Fisica Sperimentale del Politecnico, Turin). Nuovo cimento (10) 8, 1-16(1958) Apr. 1. (In Italian)

The experimental distribution of the internal bremsstrahlung in the case of Tl^{204} β decay has been measured, with the help of a γ scintillation spectrometer. The method used in calibrating the experimental apparatus and in evaluating the true experimental spectrum is reported. In the energy interval considered the experimental distribution has been compared with the theoretical spectra calculated on the basis of the method developed by Knipp and Uhlenbeck and of the Nilsson method, which take into account, in first approximation, the influence of the Coulomb field of the nucleus. The experimental results are in disagreement with the Knipp and Uhlenbeck distribution and agree well with the Nilsson corrected distribution up to a lower limit of about 150 kev, showing, in this case the importance of the nuclear Coulomb field. Nevertheless, for energies lower than 150 kev, also the corrected theoretical spectrum is unsatisfactory; the excess of photons in the lower part of the experimental spectrum is the outstanding feature of the Tl^{204} internal bremsstrahlung. This seems to be in agreement with the results of Starfelt and co-workers, and Langevin-

Joliot for other nuclides. Owing to the fact that the Nilsson theoretical distribution is calculated for allowed transition only, the influence of the β spectrum shape (unique first forbidden in the case of Tl^{204}) cannot be excluded. Between 80 and 400 kev an intensity of $(1.0 \pm 0.1) \times 10^{-3}$ photons per disintegration has been found; the predicted intensities are 0.637×10^{-3} and 0.789×10^{-3} photons per disintegration, for the Knipp and Uhlenbeck theory and for the Nilsson corrected theory, respectively. (auth)

12032

BETA-GAMMA CORRELATIONS WITH RESONANCE FLUORESCENCE. R. R. Lewis and R. B. Curtis (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 110, 910-14(1958) May 15.

The study of beta-gamma angular correlations, with resonance fluorescence of the gamma ray, is proposed as a means of obtaining important information on the beta-decay coupling constants. The effect is calculated for an allowed beta transition followed by a gamma transition of arbitrary multipolarity. As an example, detailed numerical results are given for Ne^{23}. (auth)

12033

NATURAL RADIOACTIVITY OF V^{50} AND Ta^{180}. E. R. Bauminger and S. G. Cohen (Hebrew Univ., Jerusalem). Phys. Rev. 110, 953-7(1958) May 15.

The methods of proportional counter and scintillation spectroscopy have been used to examine the possible radioactivity of the naturally occurring nuclides V^{50} and Ta^{180}. Some positive evidence is obtained that V^{50} decays by K capture to the 1.58-Mev excited state of Ti^{50} with a half life of $(4.8 \pm 1.2) \times 10^{14}$ yr. A search for titanium K x rays gave negative results. For Ta^{180} a lower limit of $(2.3 \pm 0.7) \times 10^{13}$ years was found for the half life against decay by K capture and a lower limit of $(1.7 \pm 0.6) \times 10^{13}$ years against beta decay. (auth)

12034

DECAY OF TELLURIUM-132. G. D. Cheever, W. S. Koski, D. R. Tilley, and Leon Madansky (Johns Hopkins Univ., Baltimore). Phys. Rev. 110, 922-3 (1958) May 15.

The decay of Te^{132} produced by fission of uranium has been investigated by using a scintillation spectrometer. In addition to the previously reported 0.23-Mev gamma ray and the iodine K x ray, a 0.053-Mev gamma ray has been observed. Coincidence measurements permitted the determination of K-shell conversion coefficients for the two transitions. Probable decay schemes compatible with the observations are discussed. (auth)

12035

BETA-RAY SPECTRUM OF N^{16}. G. Brunhart, V. P. Kenney, and B. D. Kern (Univ. of Kentucky, Lexington). Phys. Rev. 110, 924-6(1958) May 15.

The beta-ray spectrum of 7.38-second N^{16} has been investigated with a 180-degree magnetic spectrometer. The radioactive nuclei were produced by 1.5-Mev deuterons through the reaction $N^{15}(d,p)N^{16}$, using targets of lead nitrate enriched to 64% in N^{15}. Of the four known beta-ray groups, two with end-point energies 10.40 ± 0.05 Mev and 4.39 ± 0.07 Mev are satisfactorily resolved. The intensity of the 10.40-Mev group relative to that of the remainder of the transitions is in the ratio of 28 : 72, leading to log f_0t = 6.67. The 10.40-Mev group is shown to proceed as a first-forbidden $\Delta J = 2$(yes) transition, and thus the ground state of N^{16} may be uniquely designated as a 2^- level. (auth)

12036

RADIOACTIVE LIQUID WASTES. PART II. Ann Arbor, The University of Michigan Publications Distribution Service, [1956]. 195p. $3.00.

The types of institutions using radioisotopes are described. The ways that radioisotopes are being used in industry and medicine are described. Effects of and on receiving waters and environment and effects of and on water treatment processes and personnel by radioactivity in the water supply are discussed. (W.L.H.)

Rare Earths and Rare-earth Compounds

Refer also to abstract 11783.

12037

CERITE FROM MOUNTAIN PASS, SAN BERNARDINO COUNTY, CALIFORNIA. Jewell J. Glass, Howard T. Evans, Jr., M. K. Carron, and F. A. Hildebrand (U. S. Geological Survey, Washington). Am. Mineralogist 43, 460-75(1958) May-June.

Cerite, a silicate of cerium and lanthanum, occurs with bastnaesite in one of the rare-earth-bearing veins of the Mountain Pass district, California. The deposits of rare-earth minerals are in a mineralized zone in shonkinite in an area of Precambrian metamorphic rocks. The minerals associated with cerite are: bastnaesite, barite, quartz, chalcedony, calcite, galena, and altered acmite. Cerite is verona brown and occurs in massive form and in crystals. The crystals are pseudo-octahedral and range in size from 2 to 7 mm. The mineral has a resinous luster, a hardness greater than 5, and no observable cleavage. It gelatinizes in hot acid. The specific gravity as determined on the Berman microbalance is 4.78 ± 0.11. The mineral is uniaxial positive, and the indices of refraction are $\omega = 1.806$ and $\epsilon = 1.808$. X-ray single-crystal studies show that the crystals are rhombohedral rather than orthorhombic as suggested by Nordenskiöld, and have the following characteristics: space group $R\bar{3}c(D_{3d}^6)$ or $R3c(C_{3v}^6)$; hexagonal a = 10.78 ± 0.08 A, c = 38.03 ± 0.27. Crystal forms present are c{0003}, e{01$\bar{1}$2}. The chemical analysis of purified material, after about 4% of impurities are subtracted, is interpreted in terms of chemical, physical and crystallographic properties to give the tentative formula: $(Ca, Mg)_2(RE)_8[(SiO_4)_{7-x}(FCO_3)_x][(OH)_x(H_2O)_{3-x}]$. (auth)

12038

EUROPIUM HEXABORIDE. G. V. Samsonov, V. P. Dzeganovskii, and I. A. Semashko (Inst. of Ceramics and Special Alloys, Academy of Sciences, Ukrainian SSR). Doklady Akad. Nauk S.S.S.R. 119, 506-7(1958) Mar. 21. (In Russian)

The x-ray-diffraction diagram of europium hexaboride ($Eu_2O_3 + 3B_4C \rightarrow 2\ EuB_6 + 3\ Co$) revealed that the compound possesses a cubic lattice with a = 4.167 ± 0.002 A (the spatial group O_h^1 is typical of all hexaborides of rare earth metals). The x-ray density is 4.99 ± 0.01 g/cm^3. (R.V.J.)

12039

ACOUSTICAL LOSS AND YOUNG'S MODULUS OF YTTRIUM IRON GARNET. D. F. Gibbons and V. G. Chirba (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. 110, 770-1(1958) May 1.

Yttrium iron garnet and other rare earth garnets are important as a new class of magnetic oxides. Because of the variety of stress-induced relaxations which have been reported in ferrites and the anomalous peak in the ferrimagnetic resonance line width between 20 and 65°K, Young's modulus and acoustical attenuation of polycrystalline yttrium iron garnet were measured.

Two samples were prepared by sintering the oxides at 1450°C in O_2. By exciting the specimen at its third harmonic, the maximum in the attenuation is shifted to 172°K. Spheres of 0.010 in. diameter were made from each of the samples, and the ferrimagnetic line width at 16 KMe was measured at room temperature. The value of the observed activation energy is lower than would be expected from an ion migration and is more in favor of an electron migration, indicating incomplete oxidation of the metal ions in the neighborhood of the defects. (A.C.)

Shielding

12040 AECU-3701

[Atomic Power Development Associates, Inc., Detroit.]
SHIELDING OF A FAST BREEDER REACTOR—I. THE PRIMARY SHIELD. H. E. Hungerford. [1957]. 19p. $3.30(ph OTS); $2.40(mf OTS).

The differing shielding requirements of a fast breeder reactor and a thermal reactor are discussed. The functions of a stainless steel layer inside the reactor vessel of a fast breeder are outlined: neutron reflector, gamma-ray absorbing thermal shield, and an inelastic neutron scatterer to protect the vessel walls against radiation damage. The use of borated graphite outside the vessel is discussed. The rotating plug shield is described. Shielding calculations and a primary shield design drawing are given for the Fermi Fast Breeder Reactor. (M.H.R.)

12041 USNRDL-TR-241

Naval Radiological Defense Lab., San Francisco.
AN EXPLORATORY STUDY OF PROTECTION AGAINST NUCLEAR THERMAL RADIATION WITH SMOKING AND INTUMESCENT PAINTS. W. E. Shelberg and S. B. Martin. June 2, 1958. 43p.

An exploratory laboratory investigation was made on protection against nuclear thermal radiation with thermoshielding and intumescent paints. Thermoshielding paint, a new invention, protects by interposing a rapidly produced, self-generated smoke screen between substrate and radiation. Intumescent paint, commercially available, protects by expanding into a heat-insulating, sponge-like mat. Three experimental, prototype thermoshielding paints were invented, and one intumescent paint, Albi-99, was selected for study. The former consisted of Navy gray paint having tetracene (i.e., 1-guanyl-4-nitrosoaminoguanyltetrazene), nitrosoguanidine or sebacic acid as smoke-generating components. The paints were applied on thin, 3/4-in. diameter, primered copper discs. These were subjected to square-wave and simulated weapon pulse exposures with the Mitchell thermal radiation source, and curves of temperature rise versus time after incidence were determined. Degree of protection was evaluated relative to ordinary Navy gray paint, and was expressed numerically for any particular time after incidence as a percentage (A-B)/(A) × 100, where A represents the temperature rise of the Navy gray paint disc, and B that of the test paint disc. The degree of protection varied with paint and exposure characteristics. The thermoshielding sebacic acid paint protected appreciably (7 to 18%) throughout a range of simulated weapon exposures extending from one of high peak irradiance and moderate yield (22 cal/cm^2/sec and 0.2 Mt) to one of low peak irradiance and high yield (5 cal/cm^2/sec and 10 Mt). The explosively decrepitating thermoshielding paints, tetracene and nitrosoguanidine, protected appreciably (13 to 19%) when the simulated weapon pulses delivered the majority of the radiation within a few seconds, but they failed to protect when the majority was delivered during a period of many seconds. Intumescent Albi-99 protected appreciably (7 to 23%) when temperature rises were great enough (about 225 to 250°C) for formation of its relatively slowly produced foam blanket, but it failed completely for large, vary rapid temperature rises since immediate decomposition then caused loss of the intumescent property. All paints showed appreciable, sustained protection at exposures corresponding to 22 cal/cm^2/sec peak irradiance and 1-Mt yield: sebacic acid paint, 14%; tetracene and nitrosoguanidine paints, 19%; Albi-99 paint, 23%. (auth)

12042

CONTAINERS FOR Co^{60}. Z. Frynta and J. Langmajer (Inst. of Materials and Tech., Prague). Jaderna Energie 4, 98-102(1958) Apr. (In Czech)

Data are given for the determination of the wall thickness in the design of lead containers encased in thick iron encasements. The performance and practical factors of such lead-iron containers for high activity Co^{60} are discussed. (tr-auth)

Spectroscopy

12043 AECU-3702

RAND Corp., Santa Monica, Calif.
NEW DEVELOPMENTS IN THE THEORY OF PRESSURE BROADENING. Michael Baranger. Feb. 19, 1958. 169p. Contract AT(29-1)-1477. (RM-2118(AEC); AD-150692). $25.80(ph OTS); $7.80(mf OTS).

An investigation was made into various branches of the theory of pressure broadening by solving two problems: that of treating the motion of the perturbers quantum mechanically and that of overlapping lines. Both problems are solved only in the impact approximation, but this is adequate when the perturbers are electrons, which is the practical case. In addition, the validity conditions of this approximation are examined. (auth)

12044 AFOSR-TN-58-473

Cornell Univ., Ithaca, N. Y.
NOTES ON THE PROSPECTIVE USE OF THE ORBIT-RADIATION OF A HIGH-ENERGY SYNCHROTRON IN X-RAY PHYSICS IN THE 0.1 TO 20A REGION. Technical Note No. 12. L. G. Parratt. May 1, 1958. 14p. Contract AF18(600)-300. (AD-158284).

The classical theoretical predictions of Schwinger on the electromagnetic radiation from high-energy electrons in circular orbits are evaluated and confirmed (Tomboulian, Phys. Rev. 102, 1423-77(1956)), and the results are put in practical form for spectrographic work in the wavelength region from 40 to 800 A. These results are extended, by calculation, to apply to prospective experiments in the range 0.1 to 20 A. The total power radiated and the spectral distribution are calculated and then the beam geometry is discussed. The expressions for the average power for the 1-Bev and 6-Bev beams are derived. Comparisons are made with the synchrotron beam and conventional beams and their use with different instruments. The problems of detection and background radiation are discussed. (J.S.R.)

12045 UCRL-3619

California. Univ., Berkeley. Radiation Lab.
CHARACTERISTICS OF A LEAD-GLASS PHOTON SPECTROMETER AND ITS USE IN STUDYING THE ABSORPTION OF PHOTONS AND ANTINUCLEONS (thesis). John M. Brabant. Dec. 12, 1956. 60p. Contract W-7405-eng-48. $9.30(ph OTS); $3.60(mf OTS).

A spectrometer for analyzing photons of energies

extending up to several Bev was constructed. This instrument contains in a lead-glass medium a large fraction of the cascade shower that is initiated by the incoming photon and observes by means of phototubes the Cherenkov radiation that is emitted by the electrons in the shower. It was calibrated up to 1.5 Bev photon energy, and its response is very nearly linear. Using this device, a good-geometry experiment was performed to measure the electron-pair production cross sections at 2.5 ± 0.5 Bev in lead and aluminum. Photons from an internal target of the Bevatron were used. The measured cross sections were 34.6 ± 6.6 b in lead and 1.22 ± 0.17 b in aluminum. In a modified form, this instrument was used to study the interaction of antiprotons in matter. Estimates of the efficiency for containing the annihilation products and of the type and multiplicity of these products indicate that the pulse spectra that are expected to be observed are compatible with those measured. Attenuation effects in a copper absorber and the lead glass indicate that the absorption cross sections are about twice geometric at about 450 Mev and increase as the antiproton energy decreases below 450 Mev. (auth)

12046

THE THEORY OF COLLISION-INDUCED ABSORPTION IN HYDROGEN AND DEUTERIUM. F. R. Britton (Hamilton Coll., McMaster Univ., Hamilton, Ontario, Can.) and M. F. Crawford (Univ. of Toronto, Ontario, Can.). Can. J. Phys. 36, 761-83(1958) June.

Collision-induced absorptions in the 1−0 vibrational band of hydrogen and deuterium are calculated by considering interactions during binary collisions. The induced dipole moment, μ, of an interacting molecule-pair is derived by combining a moment, μ_a, resulting from overlap forces, with a moment, μ_q, due to the interactions of permanent molecular quadrupole moments. μ_a consists of two additive parts, an indirect part calculated by van Kranendonk and Bird (1951) and a direct part calculated in this paper. μ_q is calculated in two different ways: (a) theoretically and (b) semiempirically. Absorption coefficients are evaluated for temperatures 296 and 80°K. For H_2 at 296°K the total integrated coefficient obtained by using procedure (a) is 8.6% smaller and by using (b) is 8.2% larger than the experimental value. The experimental ratio of the coefficients of the Q and S branches is in much better agreement with (b) than (a). For T = 80°K the experimental value of the total integrated coefficient is only 61% of that calculated by (b). The good agreement between calculated and experimental values of absorption coefficients at room temperature suggests that at low temperatures the classical distribution function used in this paper must be replaced by the quantal pair distribution function. Experimental data for D_2 are not available. (auth)

12047

INTERFEROMETRIC MEASUREMENTS OF ISOTOPE SHIFTS IN MERCURY II AND MERCURY III WITH ENRICHED ISOTOPES. R. W. Shorthill and G. R. Fowles (Univ. of Utah, Salt Lake City). J. Opt. Soc. Amer. 48, 459-60(1958) July.

Interferometric measurements of isotope shifts in the visible region of a number of lines of singly and doubly ionized mercury have been made from sources containing enriched isotopes Hg^{198}, Hg^{200}, and Hg^{202}. In particular those lines having large isotope shifts were carefully studied. The results indicate a constant value, within experimental limit, of the ratio of the shift of $Hg^{198}-Hg^{200}$ to that of $Hg^{200}-Hg^{202}$. (auth)

12048

SOURCE OF HYDROGEN IONS PULSED AT VERY LOW FREQUENCY BY A TITANIUM FILAMENT. J. Desjonqueres and R. Geller (Centre d'Etudes Nucléaires, Saclay, France). Le Vide No. 68, 162-6(1957) Mar.-Apr. (In French)

A pulsed radiofrequency hydrogen-ion source is described. The pulsed discharge is obtained by periodical increasing of the source pressure due to the outgassing of hydrogen by periodical heating of a titanium filament. (T.R.H.)

12049

EFFECT OF ENVIRONMENTAL NUCLEI IN ELECTRON SPIN RESONANCE SPECTROSCOPY. T. G. Trammell, Henry Zeldes, and Ralph Livingston (Oak Ridge National Lab., Tenn.). Phys. Rev. 110, 630-4(1958) May 1.

Occasionally an electron paramagnetic resonance absorption line is accompanied by satellite lines which result from a weak magnetic dipole-dipole interaction coupling the electron spin to a neighboring nuclear spin. The satellites correspond to a change in spin state of the neighbor nucleus concurrent with the change in spin state of the electron. Expressions for the energy levels and transition probabilities for a spin-only electron coupled to neighboring nuclei are given. An example of atomic hydrogen in a glassy solid coupled to nearby protons is treated, and some of the more general consequences of the interaction are pointed out. (auth)

12050

POSSIBLE ANALOGY BETWEEN THE EXCITATION SPECTRA OF NUCLEI AND THOSE OF THE SUPERCONDUCTING METALLIC STATE. A. Bohr, B. R. Mottelson, and D. Pines (Univ. of Copenhagen and Nordisk Inst. for Teoretisk Atomfysik, Copenhagen). Phys. Rev. 110, 936-8(1958) May 15.

The evidence for an energy gap in the intrinsic excitation spectrum of nuclei is reviewed. A possible analogy between this effect and the energy gap observed in the electronic excitation of a superconducting metal is suggested. (auth)

12051

SENSITIVE, QUANTITATIVE RECORDING X-RAY SPECTROMETER. Gotfred E. B. Barstad and Ivar N. Refsdal (Norwegian Defence Research Establishment, Kjeller, Norway). Rev. Sci. Instr. 29, 343-8(1958) May.

A spectrometer has been developed with the object of achieving a high diffraction efficiency, low background, and stability and convenience in operation. A mechanism is used to position the detector and crystal in relation to the sample, for determining extended spectra by Johann's and Cauchois' methods. Sample-chambers with radiation shielding walls are used, and the outlet for fluorescent radiation is designed for reducing background. Microsamples can be used to simplify the evaluation of quantitative results. A vacuum-chamber has been designed for further reducing background. 4 × 7 cm crystal lamellae on glass supports are prepared from blocks of NaCl or LiF and bent cylindrically for line focusing, or double-curved for point-focusing to increase the intensity at particular wavelengths, the focusing always being aberration-free. The equipment has been calibrated for microquantitative determination of 30 elements, and an absolute sensitivity of 2×10^{-10} g has been achieved for the elements Co−Zn. (auth)

12052

GEARING SYSTEM FOR A CONTINUALLY-ALIGNED TWO-CRYSTAL X-RAY SPECTROMETER. Harold P. Hanson and Richard Economy (Univ. of Texas, Austin). Rev. Sci. Instr. 29, 420-2(1958) May.

A two crystal x-ray spectrometer which is able to scan continuously through Bragg angles of 10 to 45° has been put into operation. The appropriate angular changes of the components, first pointed out by Allison, are effected through a planetary gear system. The unit in use is adapted to a Norelco goniometer. (auth)

12053

COMPACT CURVED-CRYSTAL X-RAY SPECTROMETER. L. S. Birks, E. J. Brooks, and G. W. Gourlay (U. S. Naval Research Lab., Washington). Rev. Sci. Instr. 29, 425-6(1958) May.

A curved-crystal spectrometer has been designed with all the mechanism except the crystal and detector arms contained in a box $6 \times 7 \times 3\frac{1}{2}$ inches. Three sets of arms are provided for focusing circles of 10-, 20-, and 40-cm radius. Either automatic drive at from $\frac{1}{2}$ to 8 degrees 2θ per minute or manual scanning may be used. Precision-cut commercial gears result in accurate positioning and less than 0.01° 2θ backlash in the drive mechanism. Thus the spectrometer is satisfactory for use with rather perfect crystals such as quartz as well as with the alkali halides. Interchange of crystals and alignment of new crystals is simple and rapid. (auth)

12054

LIMITING RESOLUTION OF ELECTRON SPECTROMETERS. L. Marton (National Bureau of Standards, Washington). Rev. Sci. Instr. 29, 438-40(1958) May.

The performance of electron spectrometers is compared by plotting the energy or the momentum resolution vs. the transmission of the instrument. Empirical relationships are derived for the grouping of the performances of randomly chosen instruments. (W.D.M.)

12055

USE OF β SPECTROMETERS WITH LINEARLY INCREASING MAGNETIC FIELD. G. A. Gorma and E. F. Pocza (Eotvos Univ., Budapest). Rev. Sci. Instr. 29, 442-3(1958) May.

The properties of β spectrometers with linearly increasing and subsequent homogeneous fields are investigated. The equations of motion are given for the linearly increasing range, the solutions of which are sufficiently good approximations for any angular deviations. (W.D.M.)

12056

ON DIFFERENTIAL ELECTROSTATIC FIELDS IN THE SPECTROSCOPY OF CHARGED PARTICLE BEAMS. M. I. Korsunskii and V. A. Bazakutsa (V. I. Lenin Kharkov Polytechnic Inst.). Soviet Phys. (Doklady) 2, 179-81(1957) Mar.-Apr.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 10367.

12057

A HOMOGENEOUS FIELD BETA RAY SPECTROMETER WITH COMPENSATED SPHERICAL ABERRATION. K. A. Dolmatova and V. M. Kel'man (Physico-Tech. Inst., Academy of Sciences, USSR). Soviet Phys. (Doklady) 2, 196-8(1957) Mar.-Apr.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 10182.

12058

THE NEGATIVE ION H_2^-. V. I. Khvostenko and V. M. Dukel'skii (Inst. of Physics in Tech., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 1026-7(1958) Apr. (In Russian)

An attempt was made to find the negative H_2^- ion by using the recharge method. H^-, O^-, and OH^- ions were observed in the source in the presence of aqueous vapor; with the addition of antimony vapors, Sb^-, Sb_2^+, and Sb_3^- ions appeared simultaneously with mass-2 negative ions. The mass-2 negative ions are considered to be H_2^-. The observed ion fragments with mass 0.5 served as additional proof to the presence of the H_2^- ions in the apparatus. It was assumed that the 0.5-mass ions formed during H_2^- dissociation outside the source. (R.V.J.)

Theoretical Physics

12059 NP-6779

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

THE COULOMB EFFECT IN β DECAY. Report No. 19/VII. A. Deloff. Apr. 1958. 11p.

An exact coulomb wave function for β electrons is given. This wave function, possessing the full utility of the plane wave solution, simplifies the calculations and avoids the introduction of a very complex density matrix. (W.D.M.)

12060 NP-tr-104

ON A POSSIBLE LIMIT OF THE APPLICABILITY OF QUANTUM ELECTRODYNAMICS. D. I. Blokhintsev. Translated from a publication of the Joint Institute for Nuclear Research, U.S.S.R. 1958. 10p.

The processes competing with the electromagnetic at high energies are considered. It is shown that such processes may be those involving the four-fermion interactions. (auth)

12061

THE USE OF THE VARIATION PRINCIPLE IN THE NEW METHOD OF THE SUPERCONDUCTION THEORY. I. A. Kvasnikov (Steklov Inst. of Math., Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 119, 475-7(1958) Mar. 21. (In Russian)

Using Bogolyubov's variation principle, the author (Doklady Akad. Nauk 110, 755 (1956)) developed the basic phenomenological equations for the Weiss and Bregg-Williams theory. The mathematical apparatus for both theories proved to be identical. The same method was applied to the theory of phase transitions in a superconductor. (R.V.J.)

12062

AN EXAMPLE OF THE NUCLEON VERTEX. Res Jost (ETH., Zurich). Helv. Phys. Acta 31, 263-72(1958). (In German)

By means of an example it is shown that the local exchange relations and the mass spectrum do not lead to the derivation of the dispersion relation for the nucleon vertex. (tr-auth)

12063

RELATIVISTIC EQUATION FOR THE DISTINGUISHED COMPONENT OF THE STATE VECTOR. K. L. Nagy (Roland Eötvös Univ., Budapest). Nuovo cimento (10) 8, (1958) Apr. 1.

An integro-differential equation for the distinguished component of the state vector has been deduced from the Schwinger-Tomonaga equation of the interacting fields. It is proved that this equation is completely equivalent to a differential equation. These equations are the relativistic generalizations of those of W. Królikowski and J. Rzewuski: the interaction picture and arbitrary space-like surfaces have been used. As an example the dressing and the oscillation of a bare V particle in the Lee's model have been studied. (auth)

12064
ON THE QUANTIZATION OF FERMION FIELDS WITH ZERO MASS. C. G. Bollini (Comisión Nacional de la Energía Atómica, Argentina). Nuovo cimento (10) 8, 39-47(1958) Apr. 1.

The formulation of quantum field theory for massless tensor fields is extended to fermion fields with zero mass. The fermion field, which in the Rarita-Schwinger formalism is represented by a tensor spinor, is expressed in terms of simple Dirac spinors. These Dirac spinors are free components of the field, and the usual anticommutation relations are imposed on them. The corresponding anticommutation relations of the field components are given. They are compatible with the supplementary conditions. (auth)

12065
HIGHER ORDER SPINOR LAGRANGIANS. T. W. B. Kibble and J. C. Polkinghorne (Univ. of Edinburgh). Nuovo cimento (10) 8, 74-83(1958) Apr. 1.

Certain higher order spinor Lagrangians arise naturally in an attempt to write a recent theory of Feynman and Gell-Mann in conventional terms. Their quantization is investigated together with the possible forms for interactions. The theory that seems closest in spirit to that of Feynman and Gell-Mann leads to only a pseudovector interaction with pseudoscalar mesons and a Fermi interaction that is a mixture of A and V. (auth)

12066
NUCLEON-ANTINUCLEON FORCES IN THE INTERMEDIATE COUPLING THEORY. M. Lévy (Univ. of Paris). Nuovo cimento (10) 8, 92-134(1958) Apr. 1.

A semi-phenomenological approach to meson theory is used in order to calculate the nucleon-antinucleon complex interaction responsible for the scattering and annihilation of antinucleons in hydrogen. It is assumed that the main part of the imaginary potential is due to processes involving virtual annihilation into an arbitrary number of mesons, all of them but one being emitted or absorbed in a p-state. An effective Hamiltonian is derived for such processes, from which a static interaction can be calculated, the nucleon and antinucleon being treated as fixed sources. The intermediate coupling theory of Tomonaga is extended to the two-body problem and applied first to the calculation of ordinary nuclear forces and of the real part of the nucleon-antinucleon interaction. The annihilation Hamiltonian is then treated approximately by the intermediate coupling method. The imaginary part of the potential is found to have a range of the order of 2 to 3×10^{-13} cm, beyond which it becomes a weakly oscillating function of the nucleon-antinucleon distance. The physical meaning of this result is discussed, as well as the effects which would tend to sharpen the definition of the emitted pions multiplicity. In particular, a method is proposed to investigate, in the framework of the intermediate coupling theory, the influence of the excited states of the nucleon-antinucleon system. (auth)

12067
ON THE CONVERGENCE OF PERTURBATIVE EXPANSIONS. A. Buccafurri and E. R. Caianiello (Univ. of Naples and Scuola di Perfezionamento in Fisica Teorica e Nucleare, C.N.R.N.). Nuovo cimento (10) 8, 170-3(1958) Apr. 1.

It is shown that, when space-time volume Ω of integration is taken finite and the free fermion and boson propagators are bounded, in modulus, by finite quantities through some cut-off procedures, the perturbative expansions of the propagation kernels of electrodynamics and similar theories are convergent, with a finite radius of convergence. (A.C.)

12068
ON A METHOD OF COVARIANT QUANTIZATION. V. Nardi (Univ. of Padua and Istituto Nazionale di Fisica Nucleare, Padua). Nuovo cimento (10) 8, 174-8 (1958) Apr. 1.

It is shown that it is possible to obtain for the generalized Poisson brackets of the in- and out-fields, the values $\Delta(x-y)$, etc., so that the covariant quantization rules appear to be consistent and give the results of the canonical method. (A.C.)

12069
RENORMALIZATION OF AXIAL VECTOR COUPLING. J. C. Polkinghorne (Univ. of Edinburgh). Nuovo cimento (10) 8, 179-80(1958) Apr. 1.

It is pointed out that a recent suggestion of Schwinger enables one to construct an axial vector current that is conserved to the extent that one neglects the medium strong K-meson interactions. Schwinger also suggests that an isotopic scalar particle, σ, exists which is a scalar in Lorentz space and will not be seen. The existence of the σ particle enables one to construct an axial vector boson current from cross-terms with the σ and so to construct an axial vector current that is conserved. (A.C.)

12070
THE SYMMETRY PROPERTIES OF FERMI DIRAC FIELDS. B. Touschek (Univ. of Rome and Istituto Nazionale di Fisica Nucleare, Rome). Nuovo cimento (10) 8, 181-2(1958) Apr. 1.

A study is presented concerning the maximum symmetry attainable in a space formed by an n-fold Majorana field. (A.C.)

12071
MEASUREMENT PROCESS AND ALGEBRAIC PROPERTIES OF THE FIELD MAGNITUDES IN A SIMPLE MODEL FIELD THEORY. G. Heber (Univ. of Jena, Germany). Nuovo cimento (10) 8, 227-39(1958) Apr. 16. (In German)

An investigation was made of how to formulate in field theory formalism the measurement limitation appearing in the measurement of a fixed field with probes. From the exchange rule between the region and the impulse of a probe, the exchange rules between the field magnitudes and the region in which these field magnitudes dominate are derived and discussed. (tr-auth)

12072
INTERACTION OF A FIELD AND ITS SOURCE IN RELATIVISTIC FORM. E. Bellomo (Univ. of Genoa). Nuovo cimento (10) 8, 247-64(1958) Apr. 16. (In Italian)

An equation is derived which allows the calculation of the reactive force for a general field satisfying the equation $\Box h^4 = 0$. As an application the known results were obtained for the electromagnetic case and the attractive scalar case for which the dynamics of the source have characteristics similar to those of a particle with an electric charge, comprising the transient solution when the source is too little. In other cases the reactive force could cause the rest mass of the source to vary. (tr-auth)

12073
APPROXIMATION METHOD FOR THE STUDY OF THE PION-NUCLEON DIFFUSION IN S WAVES. M. Bassetti (Univ. of Rome). Nuovo cimento (10) 8, 361-2(1958) Apr. 16. (In Italian)

12074
COOPERATIVE PHENOMENA IN QUANTUM THEORY OF RADIATION. A. Gamba (Philco Corp., Philadelphia). Phys. Rev. 110, 601-3(1958) May 1.

Cooperative phenomena in a radiating system have been discussed by Dicke. A new formulation of the theory is presented, which shows more clearly the relations of these effects with the quantum-mechanical identity principle. Some theoretical and practical implications of the theory are pointed out. (auth)

12075
COMMUTATION RELATION OF DIFFERENT FIELDS AND THE TCP THEOREM. Toichiro Kinoshita (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 110, 978-81 (1958) May 15.

In proving the TCP theorem, it is customary to assume, besides other assumptions, that kinematically independent fermion fields anticommute with each other and boson-boson and boson-fermion pairs satisfy ordinary commutation relations. It is shown in an elementary fashion that this assumption is actually not necessary to prove the invariance of field theory under TCP. (auth)

12076
ON THE ROLE OF BOUND STATES IN PHOTOPRODUCTION. A. A. Logunov, B. M. Stepanov, and A. N. Tavkhelidze. Soviet Phys. (Doklady) 2, 12-14(1957) Jan.-Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 6576.

12077
TIME CORRELATION IN CLASSICAL STATISTICAL SYSTEMS CONSISTING OF A LARGE NUMBER OF INTERACTING PARTICLES. V. V. Tolmachev. Soviet Phys. (Doklady) 2, 85-9(1957) Jan.-Feb.

In some problems of the statistical physics of classical systems consisting of a large number of interacting particles it is necessary to know the correlation function $\phi_1(t, x_1 \mid x_0)$ which gives the probability for the transition of a particle of the system in time t into the infinitely small neighborhood dx_1 of the dynamical state x_1 from the dynamical state x_0. A method, using a chain of linked distribution functions, is given which gives both a deduction of the Fokker-Planck equation for $\phi_1(t, x_1 \mid x_0)$ for systems with long-range interaction (systems of the plasma type) and the deduction of the equation for systems with short-range interaction (real gases) where the concept of the Fokker-Planck mechanism cannot be applied. (J.S.R.)

12078
FERMION FIELDS AND SPINORS IN INFINITE-DIMENSIONAL SPACE. Iu. A. Gol'dfand (P. N. Lebedev Physics Inst., Academy of Sciences, USSR). Soviet Phys. (Doklady) 2, 110-12(1957) Mar.-Apr.

A relation is established between the motion of an electron in an external field and rotations of space. This relationship indicates a new procedure for solving the general problems of quantum field theory. (J.S.R.)

12079
ON THE FUNDAMENTAL RELATIVISTICALLY INVARIANT EQUATION FOR A SPIN 1/2 PARTICLE. G. A. Zaitsev. Soviet Phys. (Doklady) 2, 199-201(1957) Mar.-Apr.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 10373.

12080
PERMUTATION RELATIONS BETWEEN DIFFERENT FIELDS. Gerhard Lüders (Max-Planck-Institut für Physik, Göttingen, Germany). Z. Naturforsch. 13a, 254-60(1958) Apr. (In German)

The problem of commutation relations between different fields is analyzed on the basis of the postulate that local interaction Hamiltonians lead to local field equations. It is shown that besides the normal case (anti-commutativity of different Fermi fields, commutativity of all other fields), there can be other solutions. All these solutions are generated from the normal case by a sequence of transformations of field operators, of a type first studied by Klein. The TCP theorem holds in all these cases if it holds in the normal case. (auth)

12081
CLASSIC SOLUTIONS OF A HEISENBERG NON-LINEAR FIELD EQUATION. K. Just (Freien Univ., Berlin). Z. Naturforsch. 13a, 345-6(1958) Apr. (In German)

12082
ON THE STATIONARY SCATTERING THEORY WITH BOUND STATES. W. Brenig (Max-Planck-Institut fur Physik, Göttingen, Germany). Z. Naturforsch. 13a, 359-63(1958) May. (In German)

The matrix elements occurring in the stationary scattering formalisms with states forming a continuous energy spectrum ϵ are, in general, singular functions of ϵ. In the presence of bound states the singularities are often not explicit in appearance. With a single example it is shown what errors one might make on the basis of such hidden singularities and what precautions one must consider to avoid these errors. (tr-auth)

12083
ABOUT ONE FUNCTIONAL RELATION IN QUANTUM MECHANICS. D. A. Kirzhnits (Lebedev Inst. of Physics, Academy of Sciences, URRS). Zhur. Eksptl'. i Teoret. Fiz. 34, 1037-8(1958) Apr. (In Russian)

A system of non-interacting stable particles in an exterior field was studied. The density of the particles can be expressed by a complex function from V and its derivatives. An equation was developed which can be applied for the derivation and correction of density approximations. (R.V.J.)

12084
SECOND MOMENT IN PARAMAGNETIC ABSORPTION CURVE IN THE CASE OF VARYING MAGNETISM. U. Kh. Kopvillem (Kazan State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 34, 1041-2(1958) Apr. (In Russian)

Equations were developed for calculating the second moment in paramagnetic absorption and resonance curves of magnetically anisotropic crystals containing only magneto-equivalent ions. (R.V.J.)

Tritium and Tritium Compounds

12085
FINE STRUCTURE AND LAMB SHIFT ON THE $2s_{1/2}$ LEVEL OF THE TRITIUM T_α LINE λ 6560 A. P. S. Kireev. Soviet Phys. (Doklady) 2, 8-11(1957) Jan.-Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 6575.

12086
THE USE OF TRITIUM AS AN IONIZING SOURCE IN INSTRUMENTS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 60, Session 5. G. Frederick Vanderschmidt, Jonathan R. Roehrig, and John C. Simons, Jr.

(National Research Corp., Cambridge, Mass.). New York, American Institute of Chemical Engineers, 1958. 10p.

Plaques containing tritium gas absorbed in a zirconium layer can be used as ionizing sources in instruments. Self-absorption limits the intensity of surface radiation to a calculated value corresponding to an activity of about 0.1 curie/square inch; actual plaques have been obtained with intensities of 10% to 30% of this value. The sources are stable in high vacuum at room temperature. A vacuum gauge and a gas chromatography detector making use of these sources are described. (auth)

Uranium and Uranium Compounds

12087 AECD-4264
Carbide and Carbon Chemicals Co. K-25 Plant, Oak Ridge, Tenn.
ESTIMATES OF MINIMUM CRITICAL VOLUMES. R. C. Rohr and H. F. Henry. Feb. 15, 1952. Decl. with deletions June 3, 1958. 11p. Contract [W-7405-eng-26]. (KS-267(Del.)). $3.30(ph OTS); $2.40(mf OTS).

A study was made of the available high-assay criticality data for materials of 93.4% and 95.3% U^{235}, and minimum critical volumes were estimated for several conditions. The data, estimated for aluminum and stainless steel containers, water and air reflected, and with and without shielding, are tabulated. (J.S.R.)

12088 DP-258
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
PREFERRED ORIENTATION OF COLD-ROLLED AND RECRYSTALLIZED URANIUM PLATE. William R. McDonell. Dec. 1957. 20p. Contract AT(07-2)-1. $0.75(OTS).

The preferred orientation induced in uranium plate by mild cold rolling after beta transformation was characterized by measurement of thermal expansion coefficients. From these data, it was estimated that cold reductions of five and ten % would cause elongations of one and two % per 1000 Mwd/T, respectively, during irradiation of the plate. Recrystallization following cold work did not significantly affect the preferred orientation, but relieved intergranular stresses in the metal. The cold work and recrystallization reduced the grain size of the metal. (auth)

12089 LA-2144
Los Alamos Scientific Lab., N. Mex.
U^{238} CROSS SECTIONS AND THEIR TEMPERATURE DEPENDENCE. Joseph J. Devaney and Bertha G. Fagan. July 1957. Revised Mar. 1958. 109p. Contract W-7405-eng-36. $2.50(OTS).

A Breit-Wigner analysis of U^{238} is folded into a Maxwell velocity distribution to obtain total, scattering, and radiative capture cross sections vs. neutron energy from 0.025 to 419 ev and for U^{238} temperatures of 0.0253 to 500 ev. (auth)

12090
STUDY OF THE RADIOACTIVITY OF URANIUM USING PHOTONUCLEAR EMULSIONS. J. Catalá and J. Casanova. Anales real soc. españ. fís. y quím. (Madrid) A54, 93-100(1958) Mar.-Apr.

The radioactivity of natural uranium was studied using the photographic method. Some plates loaded with silk wires were soaked in uranium salts, and a theory to justify the existence of short-range alpha tracks is given. (auth)

12091
EQUILIBRIUM DIAGRAM OF URANIUM-IRON FOR LOW CONCENTRATIONS OF IRON. Jean Bellot, Alice Blanchon, René Chazot, Pierre Dosière, Jean-Marie Henry, and Michel Colas. Compt. rend. 246, 3063-5 (1958) May 28. (In French)

The equilibrium diagram for U-Fe alloys with an iron content less than 0.3% was studied. The results are diagrammed and show the eutectoidal character of the invariant transformation between the α and β solid solutions. (J.S.R.)

12092
SPATIAL DISTRIBUTION OF U^{238} RESONANCE NEUTRON CAPTURE IN URANIUM METAL RODS. D. Klein, W. Baer, and G. G. Smith (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 3, 698-706(1958) June.

The spatial distribution for resonance neutron capture in U^{238} was determined within a 1.3% enriched 0.387-in. diameter uranium metal rod. The resonance integral can be obtained from this distribution. (auth)

12093
TERNARY FISSION OF URANIUM BY FAST PARTICLES. N. A. Perfilov, V. P. Shamov, and O. V. Lozhkin (Radium Inst., Academy of Sciences, USSR). Soviet Phys. (Doklady) 2, 117-19(1957) Mar.-Apr.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 8247.

PATENTS

Chemistry

12094
METHOD OF SEPARATING NICKEL AND COBALT. (to Lonza Electric and Chemical Works, Ltd. (Switzerland)). British Patent 785,350. Nuclear Eng. 3, 272 (1958) June.

A mixture of nickel and cobalt hydroxides, at least a proportion of which are in divalent form, is oxidized in an aqueous medium so as to form a mixture of trivalent nickel hydroxide and trivalent cobalt hydroxide. This resulting mixture is subjected to an extraction treatment with an aqueous chlorine-containing liquor in an amount sufficient to cause dissolution of substantially all the nickel hydroxide while leaving the trivalent cobalt undissolved.

12095
METHOD AND APPARATUS FOR THE MANUFACTURE OF ANHYDROUS URANIUM FLUORIDE AND THE LIKE. M. Rouzet, J. Sauteron, and P. Kertes (to Commissariat à l'Energie Atomique). British Patent 786,800. Nuclear Eng. 3, 272(1958) June.

Continuous production, despite the tendency of the mass to swelling, and with perfect purity, is made possible by contacting countercurrently uranium dioxide powder and hydrofluoric acid gas at 500 to 600°C. The powdery material passes downward through a vertical chamber over baffles which are connected to a vibrating device so as to permit easy flow in contact with the gas.

12096
METHOD OF PURIFYING URANIUM. (to U. K. Atomic Energy Authority (U.S.A.)). British Patent 786,883. Nuclear Eng. 3, 272(1958) June.

In some uses of uranium, concentrations of boron

over 0.5 ppm are definitely objectionable. Uranium of low boron impurity may be obtained by electrolysis of a bath composed of a halide of uranium fused in a mixture of chlorides held at such a temperature that the metallic uranium is deposited as a coarse powder on a cathode of, e.g., molybdenum. Higher bath temperatures than 900°C would reduce the boron content but cause difficulties owing to excessive corrosion and liquefying of the uranium at the cathode. The removal of further amounts of boron may be effectively accomplished by burning the uranium to form an oxide and then heating the uranium oxide to above 1,000°C (preferably 1,200°C) at which temperature a substantial proportion of the boron impurities is volatilized from the oxide. The purified oxide then may be converted to the nitrate and uranium metal produced electrolytically without further increase in the boron content.

11997

PROCESSES FOR PRODUCING URANIUM TRIOXIDE. (to U. K. Atomic Energy Authority (U.S.A.)). British Patent 787,742. Nuclear Eng. 3, 272(1958) June.

Treatment of uranium tetraoxide slurries or suspensions with aqueous ammonium hydroxide gives a material which upon heating yields a uranium trioxide capable of rapid and complete reaction with carbon tetrachloride.

12098

PRODUCTION OF ZIRCONIUM TETRACHLORIDE. J. S. Broadley (to U. K. Atomic Energy Authority). British Patent 788,241. Nuclear Eng. 3, 272(1958) June.

The method is based on the discovery that the known complexes of zirconium tetrachloride with phosphorus oxychloride and phosphorus pentachloride are smoothly converted to the uncomplexed zirconium tetrachloride by bringing the vapor of the complex into contact with carbon at elevated temperature.

Engineering

12099

LUBRICANTS. A. Blainey (to U. K. Atomic Energy Authority). British Patent 787,359. Nuclear Eng. 3, 272(1958) June.

The lubricating action of graphite is partly due to an adsorbed layer of water on each of the individual flakes of graphite in the agglomerate. At high temperature graphite loses its lubricating qualities due to desorption of the adsorbed water. When graphite (or a metallic powder such as copper, bronze, aluminum) is milled with finely divided P.T.F.E. in a proportion of 6 : 1 (4 : 1) all particles become smeared with P.T.F.E. and this lubricant can be used in high-temperature work.

12100

DEVICES FOR DISCHARGING RODS OF FISSIONABLE MATERIAL FROM NUCLEAR REACTORS. (to Commissariat à l'Energie Atomique (France)). British Patent 787,971. Nuclear Eng. 3, 272(1958) June.

When letting fuel rods drop by gravity, means must be provided for absorbing the shock, so that they are not broken by their fall. Use of viscous material may soil the inside of the reactor; metallic cushioning may cause uncontrollable rebound. The difficulties are overcome by a number of guiding chutes running along the end face of the moderator block passing slightly below, and parallel to, an inclined row of the channel discharge ends. Further chutes associated with the reactor shield connect the lower ends with the exterior of the reactor.

Mineralogy, Metallurgy, and Ceramics

12101

PRODUCING FILMS OF URANIUM OXIDE. (to U. K. Atomic Energy Authority (U.S.A.)). British Patent 786,733. Nuclear Eng. 3, 272(1958) June.

The relative proportions of different isotopes present in a radioactive element may be determined by measuring the intensity of the radiation given off by the element, e.g., by counting the number of alpha particles emitted from a given weight of the material in a unit length of time and comparing this count with a standard sample. It has been found that the desired accuracy can be obtained by forming on a metal support (disc) an adherent film of a compound of the radioactive element (oxide of the element). A film of uranium oxide is produced on a polished metal surface (gold or a metal of the platinum-palladium group) by spraying on that surface, in atomized form, a solution of a uranium salt (uranyl chloride) in an organic solvent (amyl acetate) containing a binder. The coating is heated to convert the salt to U_3O_8.

12102

METHOD OF PRODUCING HAFNIUM-FREE "CRYSTAL-BAR" ZIRCONIUM FROM A CRUDE SOURCE OF ZIRCONIUM. (to Commonwealth Scientific and Industrial Research Organization (Australia)). British Patent 787,778. Nuclear Eng. 3, 272(1958) June.

In order to reduce the number of steps in the process of producing pure crystal bar metal, zirconium carbide is converted to the iodide, which is then purified and subsequently decomposed. Crude carbide is first formed by heating zircon sand with carbon. The conversion is then carried out by heating the carbide in a stream of iodide to form tetraiodide.

12103

BERYLLIUM ALLOYS. J. Williams and J. W. S. Jones (to U. K. Atomic Energy Authority). British Patent 788,239. Nuclear Eng. 3, 272(1958) June.

Skeletons of compacted beryllium powder are sheathed in magnesium foils or submerged in molten magnesium, then heated in an inert atmosphere sufficient to cause complete diffusion of one metal into the other. The alloys contain from 1 to 25% magnesium, the remainder being beryllium.

12104

ALLOYS OF TITANIUM OR ZIRCONIUM INTENDED FOR DRAWING INTO WIRE. J. E. Hughes (to Associated Electrical Industries, Ltd.). British Patent 788,245. Nuclear Eng. 3, 272(1958) June.

Titanium and zirconium can be more readily drawn when tungsten and/or molybdenum are alloyed with the titanium or zirconium in an amount from 0.1 to 0.5 wt. %.

Physics

12105

IONISATION COUNTER TUBE. E. Cohen (to General Electric Co., Ltd.). British Patent 786,286. Nuclear Eng. 3, 272(1958) June.

The development of a high local field at the cathode can be avoided by making the cathode from an intermediate portion or intermediate portions of at least one continuous length of wire (instead of using sheet metal tubes), so that there is no mechanical joint between any two parts of the wire. The wire forms a closely wound structure, the spacing between adjacent windings not being greater than the diameter of the wire.

PERSONAL AUTHOR INDEX

This is an index for the reports abstracted in this issue. For each reference the number preceding the dash is the volume number and the number after the dash is the abstract number. Personal author indexes are cumulated on a semiannual and annual basis.

A

ABASOV I T
12-11238
ABRAHAM LOTHAR
12-11454
ABRAMS C S
12-11418
ACOSTA RAMON SUAREZ
12-11317
ADAM J
12-11371
ADELL M ROCA
12-11315 12-11316
ADEY A W
12-11639
ADLER F
12-11833
ADLEY F E
12-11341
AGNEW L
12-11996
AGRINIER HENRI
12-11319
AGUILAR J
12-11604
AITKEN M J
12-11960
AKISHIN P A
12-11331
ALAGA GAJA
12-12027
ALAIA C M
12-11580
ALBAUGH F W
12-11834
ALCOCK K
12-11291
ALEKSANDROV S M
12-11231
ALEXANDER LYLE T
12-11306
ALIKHANOV A I
12-11559
ALIMARIN I P
12-11375
ALLAN D L
12-11732
ALLEN BENNET M
12-11243
ALLISON B
12-11627
ALLISON SAMUEL K
12-11557
ALPERS V V
12-11519
ALTSHULER L V
12-11475 12-11476
AMBLER E
12-11993
AMELINCKX S
12-11527
AMOIGNON J
12-11395
AMSTER HARVEY J
12-11586
ANDERSON P
12-11641
ANDERSON W KERNIT
12-11838
ANDREWS G A
12-11252
ANDREWS GOULD A
12-11278
ANGERMAN C L
12-11471
ANGERMAN CARL L
12-11430 12-11445
ANISOVICH V V
12-11772
ANSELM A A
12-11772
ANTONEVA N M
12-11954
APPA RAO M V K
12-11518
ARAJS SIGURDS
12-11562
ARINSHTEIN E A
12-11532
ARKER A J
12-11591
ARKULIS G E
12-11456
ARKUSZEWSKI JACEK
12-11907
ARNOLD E D
12-11898
ARNOLD W H JR
12-11878
ARSLAMBEKOV V A
12-11461
ARUTYUNYAN F R
12-12002
ASCHENBRENNER E A
12-11943
ASHBY V J
12-11741
ASKARYAN G A
12-11634
ASLING C WILLET
12-11236
ASPLUND INGER
12-12025
AUCLAIR J M
12-11713
AUERBACH S I
12-11239
AUSTERMAN S B
12-11447

B

BACCHELLA G L
12-11988
BACKSTROM GUNNAR
12-12026
BACON A
12-11305
BAER W
12-12092
BAKER MAHLON GEORGE
12-11490
BALASHKO YU G
12-12008
BALDWIN M M
12-11289
BALKE S
12-11263
BALL J G
12-11383
BANCROFT A R
12-11386
BARANGER MICHAEL
12-12043
BARASHENKOV V S
12-11638 12-11667
BARDON M
12-11651
BARIT I YA
12-12008
BARKAS W H
12-11986 12-11987
BARMIN V V
12-11660
BARNES R F
12-11707
BARNES R S
12-12012
BARNETT N L
12-11585
BARON S
12-11899
BARRETT P H
12-11986
BARSCHALL H H
12-11725
BARSHAY SAUL
12-11647
BARSTAD GOTFRED E B
12-12051
BARTENBACH M
12-11489
BARTHOLOMEW G A
12-11744
BASHILOV A A
12-11954
BASKEY RAYMOND H
12-11426
BASSETTI M
12-12073
BATEMAN J D
12-11439
BAUER GORAN C H
12-11786
BAUER HERMAN L JR
12-11435
BAUM J W
12-11927
BAUMINGER E R
12-12033
BAYARD R T
12-11876
BAYH W
12-11550
BAZAKUTSA V A
12-12056
BAZHANOV E B
12-11998
BECKER HERBERT
12-11408
BECKER K
12-11606
BEELEY RAYMOND J
12-11247
BEGZHENOV P B
12-11666
BELLARTS HENRY J
12-11915
BELLOMO E
12-12072
BELLOT JEAN
12-12091
BELOUSOV A S
12-11658
BENSON JAY L
12-11793
BERANEK J
12-11391
BERG S S
12-11878
BERGMAN A A
12-11727
BERGMAN OLOV
12-12026
BERGMANN W H
12-11878
BERKO S
12-11734
BERLOVICH E YE
12-11784
BERNSOHN E
12-11841
BERNSTEIN A M
12-11994
BERONI ERNEST P
12-11435
BERREMAN DWIGHT W
12-11531
BERRY L M
12-11409
BERSUKER I B
12-11474
BERTHELOT A
12-11988
BERTOZZI W
12-11624 12-11749
BERTRAND J
12-11885
BES DANIEL R
12-11783
BETHARD W F
12-11285
BETHE H A
12-11677
BEVIS K S
12-11601
BHOWMIK B
12-11641
BICKEL P A
12-11858
BIGELEISEN JACOB
12-11936
BIGHAM C B
12-11705 12-11706
BILDSTEIN H
12-11605
BILPUCH E G
12-11718
BIRKHOFF GERHARD
12-11546
BIRKS L S
12-12053
BISBEE F A
12-11619
BISWAS S
12-11518
BLAKER O J
12-11387
BLACKBURN PAUL E
12-11385
BLAINEY A
12-12099
BLAIZE S
12-11714
BLAKE J P H
12-11817
BLANCHON ALICE
12-12091
BLANKE B C
12-11337
BLEULER E
12-11990
BLEVIN H A
12-11551
BLOCK R C
12-11703
BLOEMBERGEN N
12-11798
BLOKHINTSEV D I
12-12060
BLOOMFIELD M
12-11487
BLUMBERG SYDEL
12-11768
BLUMENFELD H
12-11766
BOCKELMAN C K
12-11747
BODENSTEDT E
12-11812
BOGAARDT M
12-11909
BOGDANOV G F
12-11739 12-11740
BOHR A
12-12050
BOLAKAS JOHN
12-11563
BOLDUAN ORVIL E A
12-11304
BOLESLAV A
12-11249
BOLEY F I
12-11800
BOLLINGER L M
12-11684 12-11698
12-11700 12-11707
BOLLINI C G
12-12064 12-11290
BOND W H
12-11833
BONETTI A
12-11988
BONGERS PIET FRANS
12-11345
BONITZ M
12-11784
BONNER T W
12-11728
BOOMAN GLENN L
12-11307
BORELI F
12-11726
BORELIUS G
12-11493
BORESKOV G E
12-11335
BORING K L
12-11972
BOSGRA S J
12-11643
BOUSQUET E N
12-11337
BOYER K
12-11715
BOZZI R
12-11288
BRABANT JOHN M
12-12045
BRADSHAW W
12-11340
BRATENAHL A
12-11721 12-11801
BRAUNBEK WERNER
12-11495
BRAY P J
12-11790
BRAZHNIK M I
12-11475 12-11476
BRECHER G
12-11290
BRENIG W
12-12082
BRESLAV V I
12-11784
BRETON C
12-11537
BRISCOE WILLIAM L
12-11625
BRITTON F R
12-12046
BROADLEY J S
12-12098
BROMAN C T
12-11447
BRONDEL J O
12-11928
BRONOEL GUY
12-11457
BROOKS E J
12-12053
BROWN H D
12-11674
BROWN W LYNN
12-11225 12-11226
BROWN W S
12-11819 12-11914
BRUCER MARSHALL
12-11276 12-11279
BRUECKNER KEITH A
12-11789
BRULEY D F
12-11822
BRUNHART G
12-12035
BRUNING HANS
12-11491
BUCCAFURRI A
12-12067
BULLWINKEL EDWARD P
12-11361 12-11362
BUNYATOV S A
12-11668
BUPP L P
12-11834
BURAS B
12-11489
BURKE PHILIP
12-11758 12-11759
BURKHARD WILLIAM J
12-11295
BURKHARDT L C
12-11549

BURRILL E ALFRED
12-11979
BUSSARD ROBERT W
12-11894
BYALORZHESKII A V
12-11431
BYINGTON T H
12-11261

C

CABANE G
12-11469
CACACE F
12-11381
CAIANIELLO E R
12-12067
CAILLAT R
12-11424
CALDWELL JOHN TYLER
12-11230
CALHOUN ZACHARY H
12-11849
CALVIN MELVIN
12-11282 12-11283
CAMACK W G
12-11924
CAMERON A G W
12-11695
CAMPBELL J M
12-11850
CAMPION P J
12-11706 12-11744
CAMPOS F P
12-11528
CARLSON ROBERT A
12-11368
CARR H Y
12-11756
CARRON M K
12-12037
CARTER R S
12-11843
CARTER T J JR
12-11356
CASANOVA J
12-12090
CASF K
12-11833
CASTLEMAN L S
12-11453
CATALA J
12-11604 12-12090
CATRON H C
12-11741
CELLINI R FERNANDEZ
12-11315 12-11316
CENTER E M
12-12003
CERNI S
12-11873
CETINI G
12-11287
CHANG CHIEH C
12-11406
CHANG M C
12-11237
CHAPMAN A G
12-11294
CHARLES B N
12-11669 12-11670
CHARON J
12-11537
CHASANOV M G
12-11984
CHASE D
12-11692
CHASE DAVID M
12-11898
CHATSKEVICH M V
12-12003
CHAVCHANIDZE V V
12-12004
CHAVE C T
12-11819
CHAZOT RENE
12-12091
CHEEVER G D
12-12034
CHENTSOV R
12-11575
CHINOWSKY W
12-11651 12-11766
CHIRBA V G
12-12039
CHIZHOV V P
12-11998
CHOPRA K L
12-11496
CHURCHMAN A T
12-11405
CLAIBORNE H C
12-11824
CLARK GLENWOOD JR
12-11597
CLARK R J
12-11819
CLAUSNITZER G
12-11492
CLEVELAND J M JR
12-11312
CLOUD P E JR
12-11223
COBB R F
12-11851
COBURN D B
12-11821
COCCONI G
12-11650
COCCONI V T
12-11650
COCKCROFT J
12-11212
COCKING S J
12-11778
COCKRELL J L
12-11929
COHEN B L
12-11712
COHEN E
12-12105
COHEN P
12-11857
COHEN PAUL
12-11388 12-11418
12-11855
COHEN S G
12-12033
COHN H O
12-11730
COLAS MICHEL
12-12091
COLEMAN JAMES R
12-11415
COLLI L
12-11733
COLLIE C H
12-11960
COLLINS S C
12-11394
COMPERE E L
12-11429
CONGDON CHARLES C
12-11244
CONNOLLEY D J
12-11839
CONNOLLY T J
12-11206
CONSALVO V F
12-11310
COOK MARSHALL W
12-11571
COOKE-YARBOROUGH E H
12-11482
COOPER W E
12-11332 12-11396
12-11397
COPPENS RENE
12-11438
CORBETT J D
12-11295
CORBETT J W
12-12021
CORWIN J F
12-11437
COSTA A
12-11287
COSTA G
12-11653
COTE R E
12-11684 12-11698
12-11707
COTTINO F
12-11287
CRAWFORD M F
12-12046
CREUTZ E C
12-11833
CROCHOWSKI F A
12-11939
CRONKITE E P
12-11290
CRONKITE EUGENE P
12-11251
CROWTHER R L
12-11785
CUER P
12-11986
CULPEPPER LINWOOD M
12-11586
CULVER H N
12-11822
CURTIS R B
12-12032

D

DAMON PAUL E
12-11436
DANGELO N
12-11628
DANIEL R R
12-11518
DARDEN S E
12-11726
DARROW CHESTER S
12-11940
DAVIDSON R S
12-11289
DAVIES M G
12-11564
DAVIS M
12-11472
DAVIS R H
12-11728
DAVIS ROGER T
12-11224
DAVIS W JR
12-11347
DAVISON B
12-11882
DAVISON P W
12-11878
DAWSON J K
12-11382
DAY PAUL L
12-11230
DAYTON I E
12-11709
DAYTON RUSSELL W
12-11442
DE MAIO D
12-11288
DE ST MAURICE A B
12-11878
DE VRIES J P
12-11577
DEKEYSER W
12-11527
DELCHER J
12-11395
DELITZ R H
12-11769
DELOFF A
12-12059
DEMIDOV A M
12-11745 12-11746
DEMIRKHANOV R A
12-11573 12-11780
DERIAGIN B V
12-11511
DESHONG JAMES A JR
12-11900
DESJARDINS J S
12-11680
DESJONQUERES J
12-12048
DESLATTES RICHARD D
12-11977
DESPREZ SIMONE
12-11514
DESTRIBATS M T
12-11470
DETRICK LAWRENCE E
12-11266
DEUTSCH R W
12-11902
DEVANEY JOSEPH J
12-12089
DEVERALL L I
12-11836
DEVOOGHT J
12-11588
DIAMOND H
12-11707
DIBELER V H
12-11223
DICK JAMES L
12-11257
DIEHL WILLIAM F
12-11597
DIETERICH BERND
12-11267
DIMMICK ROBERT L
12-11303
DIO WOLF HEINER
12-11752
DIVEN B C
12-11736
DJOSHI M K
12-11390
DOLGINOV A Z
12-11580
DOLMATOVA K A
12-12057
DOLS CHARLES G
12-11569
DONALDSON A D
12-11448
DOROKHOV V V
12-11573 12-11780
DOSIERE PIERRE
12-12091
DOSTALOVA H
12-11249
DOTSENKO B R
12-11760
DOWNS B W
12-11769
DRABKIN G M
12-11810
DRAPER J
12-11747
DREIHELLER H
12-11262
DRELL S D
12-11978
DRESNER L
12-11696
DRIESNER ALLEN R
12-11339
DRITS M E
12-11462
DRON N A
12-11467
DUBOVSKY B G
12-11892
DUDZIAK WALTER F
12-11637
DUKELSKII V M
12-12058
DUKES E KENNETH
12-11359
DUKHIN S S
12-11511
DUNNING GORDON M
12-11234
DUNWORTH J V
12-11214
DURRIN PATRICIA W
12-11236
DURHAM R W
12-11378
DUSHIN N V
12-11662
DUTT I
12-11777
DZANTIEV B G
12-11963 12-11964
DZEGANOVSKII V P
12-12038
DZELEPOW B S
12-12029
DZHELEPOV B S
12-11954

E

ERCIOGLU IBRAHIM K
12-11406
EBERHARDT P
12-11811
ECONOMY RICHARD
12-12052
EDGAR R F
12-11972
EDMONDS A R
12-11692
EDSELL R D
12-11878
EDWARDS WILLIAM E
12-11942
EGELSTAFF P A
12-11701 12-11779
EISENBUD L
12-11587
EKSPONG A G
12-11764
ELAM CLAUDE B
12-11224
ELIOFF T
12-11996
ELWYN A J
12-11737
ENGLAND C J
12-11816
ERGUN SABRI
12-11982
ERLEBACH W E
12-11378
ERSHLER B V
12-11559
EVANS D
12-11641
EVANS HOWARD T JR
12-12037
EVANS J E
12-11702
EVANS W
12-11443
EWING REID R
12-11421

F

FACCHINI U
12-11739
FAGAN BERTHA G
12-12089
FAIN V M
12-11507
FAIRBANKS F B
12-11819
FAIRLIE I D R
12-11767
FAKIDOV I G
12-11508
FALK C F
12-11419
FEDER R
12-12014
FEINBERG R J
12-11615
FELD B T
12-11659
FELDMAN M N
12-11828
FENSTERMACHER C A
12-11747
FERGUSON A T G
12-11723
FERRARI E
12-11642
FERRARIS G M
12-11287
FERREIRA E M
12-11645
FFUERRACHER J L
12-11582
FIREMAN E L
12-11478
FISCHELL R E
12-12019
FISCHER D L
12-11923
FISHER D J
12-11942
FISTEDIS S H
12-11941
FITZGERALD J J
12-11615
FLAHERTY JAMES M
12-11911
FLANIGAN L J
12-11939
FLEISCHMANN R
12-11492
FLUHARTY R G
12-11686 12-11701
FLYNN T A
12-11821
FOK N V
12-11934
FOSTER J J
12-11815
FOWLER FARLE C
12-11648
FOWLER J L
12-11730
FOWLER W B
12-11996
FOWLES G R
12-12047
FRANCIS NORMAN C
12-11837
FRANK P W
12-11856
FRANK ROBERT C
12-11500 12-11501
FRANKE HERBERT
12-11255
FRANKLIN R
12-11492
FRAUENFELDER H
12-11813
FREEMAN JOAN M
12-11722
FRICKE G
12-11781
FRIEDMAN IRVING
12-11223
FRIEDRICH J
12-11552
FROISSART M
12-11589
FRONSDAL C
12-11556
FROST D
12-11607
FROST R T
12-11959
FRY DAVID L
12-11500
FRYNTA Z
12-12042
FUCHS M
12-11651

FULCO JOSE R
12-11992
FULMER C R
12-11712

G

GARRARD CHARLES H
12-11413
GARRARD F
12-11728
GAERTTNER E R
12-11786
GALF A JOHN
12-11973
GALKOVSKAYA K F
12-11231
GALLAGHER C J JR
12-11795
GALLAGHER J G
12-11819
GALPER M J
12-11876
GAMBA A
12-12074
GANDUSIO G
12-11338
GARAY PAUL N
12-11903
GARIFANOV N S
12-11809
GARRIGUE HUBERT
12-11510
GARTH R C
12-11791
GARWIN R L
12-11974
GAST P F
12-11834
GAUDIN M
12-11714
GAYTHER D B
12-11779
GEISS JOHANNES
12-11477 12-11516
GELLER R
12-11395 12-12048
GENGOZIAN NAZARETH
12-11245
GEORGE H F
12-11830
GERARD CHARLES
12-11886
GERLACH WALTHER
12-11494
GERMER JOHN H
12-11838
GERSHTEIN S S
12-11664
GERTZ JOHN J
12-11911
GHORMLEY JOHN A
12-12016
GIACOMELLO G
12-11381
GIBALO I M
12-11375
GIBBONS D F
12-12039
GIBBONS J H
12-11719
GIESE CLAYTON F
12-11793
GIESLER H W
12-11819
GILBERT F C
12-11997
GILL P S
12-11612
GILLY L
12-11996
GILMAN J J
12-12013
GIUFFRIDA A J
12-11420
GLAGOLEVA N N
12-11468
GLASGOW L E
12-11912
GLASOE G N
12-11737
GLASS JEWELL J
12-12037
GLAZOV V M
12-11468
GOLDFAND IU A
12-12078
GOLDIN L L
12-11814
GOLDMAN I I
12-11524
GOLDRING G
12-11792
GOLDSTEIN H
12-11682
GOLDSTEIN HAROLD
12-11293
GOLDSTEIN R P
12-11878
GOLLING E
12-11327
GONZALEZ F ALVAREZ
12-11315 12-11316
GOOD W M
12-11719
GOODMAN CHARLES D
12-11957
GORBUNOV A N
12-11966 12-11967
GORBUNOVA K M
12-11461
GORDON D I
12-12019
GORKER G E
12-11933
GORMA G A
12-12055
GORYUNOV A A
12-11943
GOURLAY G W
12-12053
GOUSSU O
12-11988
GRANADOS GONZALEZ C F
12-11603
GRANATO ANDREW
12-11404
GRAUL E H
12-11262
GRAUL EMIL HEINZ
12-11272
GRAVES H W JR
12-11878
GRAY DON N
12-11348
GRAY R J
12-11452
GRECHISHKIN V S
12-11771
GREEN FRANCIS P
12-11897
GREEN JOHN N
12-11598
GREENFIELD P
12-11383
GREENLEF R W
12-11289
GRIFFING G W
12-11836
GRILLY E R
12-11530
GRISHUK G I
12-11814
GROMOVA Z I
12-11892
GROSECLOSE B C
12-11734
GROSHEV L V
12-11745 12-11746
GROTOVSKI K
12-11784
GRUMM H
12-11539
GRUNER JOHN W
12-11434
GUAN-CHZHAO CHZHOU
12-11774
GUERON J
12-11205
GUILLON H
12-11567
GULBRANSEN EARL A
12-11385
GUNN STUART R
12-11570
GUPTA R K
12-11788
GUPTON EDWIN D
12-11277
GUREVICH I I
12-11519
GURLAND J
12-11449
GUTERMAN M B
12-11467
GUTIERREZ BERNAL R
12-11603
GUTKIN T I
12-11573 12-11780
GUTMANN P
12-11499
GUZHAVIN V V
12-11520
GVOZDEV V S
12-11804
GYFTOPOULOS E P
12-11930

H

HAFELE W
12-11904
HAINES J F
12-11819
HAJEK B
12-11302
HALF F A
12-11833
HALEY THOMAS J
12-11266
HALL LEWIS D
12-11417
HALL R N
12-11502
HALPERN J
12-11627
HAMADA GERALD H
12-11306
HAMILTON JOSEPH G
12-11236
HANAUER S H
12-11614
HANEL H K
12-11260
HANLE W
12-11632
HANNA G C
12-11705 12-11706
HANNA S S
12-11959
HANS H S
12-11612
HANSEN P GREGERS
12-11782
HANSON HAROLD P
12-12052
HANSON O G
12-11932
HARDING ROBERT S
12-11675
HARDY EDWARD P JR
12-11306
HARDY JUDSON JR
12-11636
HARRIS L A
12-11330
HARRIS R L
12-11296
HARRISON E R
12-11542
HARROLD O G JR
12-11538
HART E L
12-11650
HARTMANN BRITT
12-12025
HARVEY C H
12-11819
HARVEY G G
12-11488
HARVEY J A
12-11703
HATCH MELVIN T
12-11303
HAUSER ULRICH
12-11505
HAUSNER HENRY H
12-11451
HAVENS W W
12-11676
HAVENS W W JR
12-11680 12-11681
HAWKINS W M
12-11937
HAYDON S C
12-11551
HAYWARD R W
12-11993
HAZARD H R
12-11939
HEALY J W
12-11222
HEBER G
12-12071
HECKMAN H
12-11986
HECKMAN H H
12-11997
HEIDER L H
12-11819
HEIKKILA W J
12-11639
HELLRIEGEL WERNER
12-11281
HEMMERLE E H
12-11821
HEMS G
12-11346
HENRIKSEN THORWOD
12-11602
HENRY H F
12-11384 12-12087
HENRY JEAN-MARIE
12-12091
HERPIN ANDRE
12-11458
HERR W
12-11811
HERSKOWITZ IRWIN H
12-11253
HESS DAVID C
12-11516
HIBDON C T
12-11720
HIGGINS H M
12-11441
HIGHBY DOROTHY
12-11266
HILDEBRAND F A
12-12037
HILVETY N
12-11826
HINTON CHRISTOPHER
12-11887
HJORT G
12-11760
HOAG J BARTON
12-11948
HOCKER K H
12-11512
HOFFMAN A J
12-11483
HOLDEN R B
12-11387
HOLLADAY WENDELL G
12-11654
HOLTHUSEN HERMANN
12-11270
HOLUB F
12-11391
HOLZMANN E G
12-11592
HOMEISTER ORVILLE E
12-11946
HON JOHN F
12-11790
HOPPES D D
12-11993
HOROWITZ J
12-11947
HORST WOLFGANG
12-11255
HOUTERMANS F G
12-11610
HOWDEN H F
12-11233
HOWE L M
12-11831
HOXIE EARLE C
12-11430
HOYT H K
12-11916
HU HING
12-11757
HUBER P
12-11955
HUBERT P
12-11537 12-11685
HUCKS J S
12-11827
HUDSON R P
12-11993
HUG OTTO D
12-11256
HUGGINS JOHN C
12-11361 12-11362
12-11368
HUGHES ANN M
12-11282 12-11283
HUGHES D J
12-11678 12-11687
12-11697 12-11791
12-11947
HUGHES G A
12-11817
HUGHES J E
12-12104
HUGHES W L
12-11290
HULL D
12-11405
HUMMEL H H
12-11787
HUNGERFORD H E
12-12040
HUNT DOROTHY M
12-11237
HUNTER D
12-11878
HURDLOW WILLIAM R
12-11257
HURFORD W J
12-11850
HUTCHISON T S
12-11496

I

IAKOVLEV G M
12-11805
IGNATOVA I A
12-11465
ILLIES K
12-11207
ILYINA I L
12-11690
ILYINA L I
12-11275
INGENERI S M
12-11819
INGENERI SALVATORE M
12-11820
IOFFE B L
12-11659
ISAKOV A I
12-11727
ITO D
12-11985
ITSKEVICH E S
12-11301
IVANENKO I P
12-11520
IVANOV O A
12-11334
IVANOV O S
12-11459

J

JACOBSON J
12-11938
JAEGER ROBERT G
12-11271
JANUS ROBERT J
12-11484
JAUCH J M
12-11981
JAWOROWSKI T R
12-11355
JEALOUS A C
12-11945
JHA S
12-11788
JOHANSSON S
12-11764
JOHANSSON SVEN A E
12-11952
JOHNSON D H
12-11912
JOHNSON T H
12-11735
JOHNSON W R
12-11819
JOHNSTON HURIEL E
12-11236
JOHNSTON W G
12-12013
JOLY R
12-11685 12-11714
JONES J B
12-11450
JONES J W S
12-12103
JONES L V
12-11337
JONES M E
12-11786
JORDAN HARRY S
12-11221
JORDAN P
12-11300
JOSHI M C
12-11788
JOST F
12-11302
JOST RES
12-12062
JOST W
12-11298
JUST K
12-12081

K

KADANER E S
12-11462
KADOMTSEV B B
12-11999
KAGAN YU
12-11609
KALININ S P
12-11739 12-11740
KALOS M
12-11682
KAMAEV A V
12-11892

KANAVETS V P
12-11660
KANER E A
12-11526
KARANOVICH G G
12-11323
KASSCHAU K
12-11819
KAUFMAN W F
12-11822
KAUFMANN A R
12-11448
KEEFF D
12-11641
KEEPIN G R
12-11711
KELDYSH L V
12-11535
KELLEY M T
12-11342
KELMAN V M
12-12057
KEMP H T
12-11289
KEMPNER E S
12-11619
KENNETT T J
12-11684
KENNEY V P
12-12035
KEREIAKES J G
12-11228
KERLER WERNER
12-11505
KERLEY PAUL L
12-11566
KERN B D
12-12035
KERNAN A
12-11641
KERNER H J
12-11812
KERTES P
12-12095
KHALETSKII M M
12-11806 12-11807
KHATANOVA N A
12-11465
KHRISTIANSEN G B
12-11523
KHVOSTENKO V I
12-12058
KIBBLE T W B
12-12065
KIEFER HANS
12-11328
KINCHIN G H
12-12015
KING C J III
12-11355
KING LESTER J
12-11428
KING R W
12-12030
KINOSHITA TOICHIRO
12-12075
KIPPENHAHN R
12-11548
KIREEV P S
12-12085
KIRZHNITS D A
12-12083
KLASSEN V I
12-11371
KLEIN D
12-12092
KLOTZ C E
12-11821
KLOTZBACH R J
12-11945
KNOWLES J W
12-11744
KOBZAREV I YU
12-11661
KOCH L
12-11499 12-11601
KOEHLER W C
12-11504
KOHMAN T P
12-11329
KOLEVATOVA V S
12-11320
KOMAR A P
12-11998
KONYUKOV M V
12-11554 12-11976
KOPFERMANN H
12-11781
KOPVILLEM U KH
12-12084
KOPYLOVA D K
12-11668
KORABELNIK R K
12-11324
KORNFELD LOTTIE
12-11242
KORSHUNOV B G
12-11353
KORSUNSKII M I
12-12056
KOSKI W S
12-12034
KOVRIZHNYKH L M
12-11975
KOWALSKA KRYSTYNA
12-11908
KOZYREV B M
12-11809
KRAUSE JOSEPH F
12-11897
KRAYBILL HENRY L
12-11648
KRIEGER THEODORE J
12-11837
KRIVITSKII V V
12-11656
KRONBERGER H
12-11564
KROPP WILLIAM A
12-11594
KRUPNIKOV K K
12-11475 12-11476
KRYLOV F I
12-11320
KUANG-CHAO CHOU
12-11983
KUCHAEV V L
12-11335
KUCHOWICZ BRONISLAW
12-11763
KUHN G
12-11513
KUHN W
12-11574
KULCHITSKII L A
12-11998
KULP J LAURENCE
12-11436
KUMPF JOACHIM
12-11267
KUMPF WALTHER
12-11267
KUMSISHVILI V A
12-12004
KURCOFF D
12-11925
KUREK JOHN JR
12-11829
KUTUKOVA V M
12-11519
KVASNIKOV I A
12-12061

L

LABEYRIE JACQUES
12-11265
LALLEMANT C
12-11440
LAMB W R
12-11599
LANDAU C
12-11761
LANDE K
12-11651
LANDER R
12-11996
LANDON H H
12-11683 12-11737
LANE A M
12-11694
LANGMAJER J
12-12042
LAPIDUS L I
12-11663
LAPOINTE J R
12-11418 12-11869
12-11871
LARSSON KARL ERIK
12-11750
LASKAR WILLIAM
12-11758 12-11759
LAWRASON F DOUGLAS
12-12030
LAWTON C W
12-11830
LE GALLIC Y
12-11608
LEA ROBERT
12-11648
LEBEDEV A N
12-11975
LEBLANC J M
12-11698
LECOUSTEY P
12-11885
LEDENEV B N
12-11475
LEDERMAN L M
12-11651 12-11766
LEE ROBERT W
12-11501
LEETZ HANS-KARL
12-11280
LEFEVRE H W
12-11446
LEGVOLD SAM
12-11562
LEIDER H R
12-12022
LEISTNER MANFRED
12-11600
LEITNER J
12-11640
LEIVO W J
12-11529
LEMON E H
12-11934
LEPPERT G
12-11924
LEROY J
12-11714
LESLIE J K
12-11819
LEVINE N
12-11813
LEVINE Z
12-11921
LEVINTOV I I
12-11753
LEVKOVSKII V N
12-11808 12-11963
12-11964
LEVY F
12-11988
LEVY M
12-12066
LEWIS LAWRENCE
12-11422
LEWIS R R
12-12032
LHOIR JEAN
12-11886
LICHTENBERG D B
12-11646
LIEBERMAN R M
12-11854
LIKHTMAN V I
12-11463
LIM T G
12-11643
LINCOLN THOMAS A
12-11277
LINTNER K
12-12020
LIVINGSTON RALPH
12-12049
LLEWELLYN P M
12-11797
LLOYD R
12-11418
LOESER E H
12-11416
LOEWENSTEIN W B
12-11787
LOGUNOV A A
12-12076
LOMER W M
12-11292
LONBERG-HOLM KARL
12-11282
LONG E L JR
12-11452
LOSCUTOV YU M
12-11561
LOUNSBURY M
12-11705
LOVBERG R H
12-11543
LOVE JOSEPH E
12-11940
LOW F E
12-11995
LOW W
12-11797
LOWMAN ARNOLD N
12-11593
LOZHKIN O V
12-12093
LOZINSKII M G
12-11467
LUBARSKY B
12-11839
LUCKE KURT
12-11404
LUDERS GERHARD
12-12080
LUKIN A M
12-11922
LUKYANOV S YU
12-11553
LUNDIN M I
12-11823
LUTSENKO V N
12-11745
LUZZIO A J
12-11227
LYNN J E
12-11694
LYUBIMOV V A
12-11559

M

MACDONALD JOHN E
12-11942
MACHOL ROBERT E
12-11480
MACPHEE J
12-11821
MADAN B K
12-11788
MADANSKY LEON
12-12034
MAGEE J M
12-11929
MAHAN BOYD L
12-11366
MAISKY I N
12-11239
MAJUMDAR ANIL KUMAR
12-11376
MAKINODAN TAKASHI
12-11244 12-11245
MALIEVSKII A D
12-11963 12-11964
MALINOWSKI J
12-11311
MANDEVILLE C E
12-11979 12-11980
MANENKOV A A
12-11805
MANN A K
12-11994
MANNING G
12-11744
MARCAZZAN G
12-11733
MARCH N H
12-11545
MARCH P V
12-11743
MARDON P G
12-11383
MARGOLIS B
12-11691
MAROPIS N
12-11450
MARSHAK H
12-11683
MARSHALL J F
12-11587
MARTIN R
12-11344
MARTIN S B
12-12041
MARTON L
12-12054
MASCH FRITZ
12-11280
MASON E A
12-11420
MATANO TSUNEO
12-11596
MATLACK J D
12-11568
MATTAUCH J H E
12-11329
MATTHIAS E
12-11812
MATUSZAK A H
12-11350
MAUPIN A A JR
12-11486
MAUSHART RUPPRECHT
12-11328
MCCLAINE LESLIE A
12-11362 12-11363
12-11364 12-11365
12-11366 12-11367
MCCLURE A C
12-11833
MCCONIGA M W
12-12024
MCDANIEL WEYMOUTH N
12-11946
MCDONELL WILLIAM R
12-12088
MCDOWELL A A
12-11225 12-11226
MCDOWELL ARNOLD A
12-11224
MCELROY W N
12-11487
MCEWEN L H
12-11834
MCINTOSH T W
12-11821
MCKAY H A C
12-11291
MCKAY S D
12-11819
MCKEEHAN M
12-11873
MCMILLAN D E
12-11786
MCMURRAY W R
12-11960
MEDICUS G
12-11541
MEDIN A L
12-11819 12-11914
12-11917
MEEM J L
12-11819
MEETZ K
12-11904
MELKONIAN E
12-11680 12-11681
MENDELL J S
12-11229
MENEGHETTI D
12-11787
MERCKX K R
12-12018
MERICLE LEO W
12-11235
MERICLE RAE PHELPS
12-11235
MERIEL PIERRE
12-11458
MERZ E
12-11811
MESERVEY A R
12-11377
METZE GERNOT
12-11578
METZGER F R
12-11799
MEUNIER R
12-11611
MEYER ANDRE P
12-11458
MEYER V
12-11776
MIDDLEMAS N
12-11960
MIKHAILOV A I
12-11213
MILLER A V
12-11753
MILLER G J
12-11565
MILLER M A
12-11498
MILLER YU G
12-11464
MILLS R L
12-11530
MILLS S N JR
12-11483
MILNER G W C
12-11305
MINAMI S
12-11985
MINGAZIN T A
12-11533
MINTON GEORGE H
12-11879
MISHAKOVA A P
12-11519
MITSUK V E
12-11540
MIURA ISAO
12-11596
MOERS K
12-11423
MOFFET A T
12-11800
MOGFORD I L
12-11405
MOHR HANS
12-11273 12-11280
MOORE G E
12-11427 12-11485
MOORE R V
12-11887
MORGAN D T
12-11357
MOROZOV B V
12-11660
MOROZOV I S
12-11353
MORPURGO G
12-11794
MORRISON G C
12-11723
MORTON W T
12-11743

MOTEFF J
12-12017
MOTTELSON B R
12-12050
MUIRHEAD E G
12-11627
MUKHERJEE ASIT KUMAR
12-11976
MUKHERJEE I P N
12-11777
MUKHIN A I
12-11657
MURPHY E L
12-11937
MUTH HERMANN
12-11254

N

NAGGIAR V
12-11724
NAGY K L
12-12063
NAKADA H P
12-11738
NANCE P D
12-11912
NARDI V
12-12068
NARIN F
12-11925
NARTEN A
12-11574
NATHAN O
12-11782
NEED JOHN L
12-11957
NEELAKANTAN K A
12-11518
NEIBAUR G E
12-11407
NEIFAKH A A
12-11240
NEILER J H
12-11719
NEMETH JUDIT
12-11956
NEMIROVSKII P E
12-11961
NEWKIRK L L
12-11741
NEWLON C E
12-11384
NEWMAN L W J
12-11888
NEWSON H W
12-11717 12-11718
NEWTON ROGER G
12-11796
NG JAMES
12-11903
NICHOLS P F
12-11718
NICHOLSON K P
12-11779
NICOLL D
12-11833
NICOLL P A
12-11852
NICOLL R C
12-11577
NICOLLE JACQUES
12-11333
NIELSEN O B
12-11782
NIEMI R O
12-11938
NIKOLSKII B A
12-11519
NISHIMURA D T
12-11358
NIXON ALAN C
12-11949
NOAKS J W
12-11819
NORDHEIM L W
12-11833
NORTHROP J A
12-11715
NORTHROP JOHN A
12-11630
NORTON R E
12-11655
NOSOV V G
12-11962
NOVAKOVA OLGA
12-11613
NOWICK A S
12-12014

O

OBY P V
12-11819
OCHS LEONHARD
12-11389
ODA MINORU
12-11596
ODEBLAD ERIK
12-11314
ODEN P H
12-11580
ODING I A
12-11466
ODONNELL ASHTON J
12-11215
OESCHGER H
12-11610
OKUN L B
12-11665
OLDEKOP W
12-11905
OLEKSA SOPHIE
12-11737
OLSHANOVA V V
12-11321
OMNES R
12-11589 12-11590
ONGMAN H D
12-11918
ORLOV V V
12-11892
OSTROVSKII V S
12-11463
OSWALD L
12-11996
OVSEPYAN E N
12-11313
OWEN DONALD B
12-11584
OWEN LOUIS E
12-11398
OWENS J E
12-11912
OXLEY C L
12-11991

P

PACE E L
12-11380
PAIC M
12-11969
PAINTER R B
12-11290
PALLADINO N J
12-11872 12-11874
PALMEIRA R A R
12-11517
PANGHER J DE
12-11595
PANOV A A
12-11690
PAOLINI F R
12-11624
PARKER PERCY G
12-11563
PARRATT L G
12-12044
PARSI E J
12-11420
PASMA P J
12-11731
PATSKEVICH V M
12-11558
PATTERSON D R
12-11936
PAULSEN F R
12-11208
PELEKHOV V I
12-11745
PENNY S K
12-11581
PENSELIN S
12-11781
PERFILOV N A
12-12093
PERKINS J F
12-12030
PERKINS K T
12-11916
PERKINS L R
12-11228
PERLMUTTER M
12-11403
PERSHIN I I
12-11660
PETERS B
12-11518
PETERSON J M
12-11721 12-11801
PETROV P V
12-11275
PETRU F
12-11302
PETTUS W G
12-11709
PFANN JAROSLAV
12-11893
PHILLIPS G C
12-11724
PHILLIPS R J N
12-11765
PIGNANELLI M
12-11733
PINES D
12-12050
PISTUNOVICH V I
12-12000
PITT CHARLES H
12-11379
POCHON M
12-11300
POCZA E F
12-12055
POHLIT WOLFGANG
12-11631
POINTUD R
12-11424 12-11425
POLEZZO S
12-11338
POLKINGHORNE J C
12-11767 12-12065
12-12069
POMERANCHUK I YA
12-11659 12-11665
PONCE DE LEON J MONTES
12-11603
POPOV V S
12-11773
POPOV YU P
12-11727
POPOVA I V
12-11657
PORTER C E
12-11689
PORTER CHARLES E
12-11768
POSEY W J
12-11844
POST RICHARD F
12-11219
POTTER R
12-11891
POVAROVA K B
12-11460
POWELL W
12-11996
POWERS R M
12-11387
POZDYAKOV A A
12-11354
PRADAL FERDINAND
12-11555
PRANATIS A L
12-11453
PRELEC K
12-11969
PREOBRAZHANSKY B K
12-11784
PREOBRAZHENSKII B K
12-11954
PREVOT ROBERT
12-11255
PRICE WILLIAM J
12-11635
PRINCE W S
12-11938
PROKHOROV A M
12-11673 12-11805
PROWSE D J
12-11641
PRZYRYLSKI A
12-11549
PURSER P R
12-11260
PUTNAM D F
12-11833
PUZIKOV L D
12-12005

Q

QUAN J T
12-11509
QUASTLER H
12-11290

R

RABINOVICH M S
12-11970
RADKEVICH I A
12-11690
RAHDINO T
12-11848
RAINEY R H
12-11377
RAINWATER J
12-11680
RANDOLPH BURR H
12-11940
RAPOPORT I D
12-11633
RASMUSSEN V K
12-11799
RAY ROBERT D
12-11286
RAYBURN L A
12-11742
RAYNE JOHN A
12-11503
REDDING G B
12-12012
REED S A
12-11429
REFSDAL IVAR N
12-12051
REGIER R B
12-11308
REIN JAMES E
12-11307
REMY ERNST
12-11953
RENE M
12-11988
RENGEL J C
12-11870
RENNIE C A
12-11818
REUT A A
12-11656
REVEL D
12-11988
RHODE G K
12-11821
RICCI R A
12-12031
RICE W S
12-11830
RICHARDS J E
12-11889
RICHARDS W M S
12-11819
RICHMOND CHESTER R
12-11284
RIGHTON F G
12-11890
RIVERS W K JR
12-11626
RIVKIND A I
12-11770 12-12006
ROBERT PIERRE-OCTAVE
12-11264
ROBERTSON J A L
12-11383
ROBINSON MARK T
12-11897
ROBSON M J
12-11285
ROCLAWSKICONJEAUD M
12-11724
ROEHRIG JONATHAN R
12-12086
ROGER J
12-11425
ROHR R C
12-12087
ROMANOFF E B
12-11237
RONNE B E
12-11764
ROSEN J
12-11680
ROSEN M A
12-11821
ROSENBLATT D B
12-12014
ROSENTHAL M W
12-11825
ROSENZWEIG N
12-11699
ROSEO L
12-11883
ROSINSKI JAN
12-11274
ROSLER L
12-11747
ROSS MARC
12-11646
ROSSI A
12-11813
ROSSLE E
12-11512
ROSSMASSLER W R
12-11296
ROSTOKER N
12-11833
ROTHE J P
12-11432
ROTHMAN M A
12-11775
ROTT N N
12-11240
ROUBAULT MARCEL
12-11438
ROUZET M
12-12095
RUBLE J B
12-11614
RUDENKO N P
12-11373
RUF HUGO
12-11281
RUKHADZE A A
12-12007
RUSINOV L I
12-11804 12-11810
RUSSELL J T
12-11446
RUTHERFORD HENRY A
12-11351
RYAN D F
12-11929
RYBAKOV B V
12-11739 12-11740
RYNDIN R M
12-11983
RYPAR V
12-11992
RYTINA KAREL
12-11971
RZEWUSKI H
12-11489

S

SACTON J
12-11988
SAGANE RYOKICHI
12-11637
SAIASOV IU S
12-11672
SAILOR V L
12-11683 12-11704
SALKOVA E G
12-11232
SAMPSON J B
12-11786
SAMSONOV G V
12-12038
SANDERS J F
12-11947
SANFORD E R
12-11852
SAPORTE ROBERT
12-11555
SARGENT C P
12-11674 12-11749
SAUTERON J
12-12095
SAVITSKII E M
12-11460
SAVORNIN FRANCE
12-11497
SAWYER G A
12-11543
SAWYER R F
12-11644
SCARGILL D
12-11291
SCARSI L
12-11988
SCHAFFER O A
12-11965
SCHAFFER STANLEY G
12-11913
SCHARENBERG R P
12-11792
SCHEIB F J
12-11591
SCHEIDEGGER A E
12-11401
SCHEIDWIMMER M
12-11881
SCHIFF D
12-11751
SCHILTZ R J
12-11936
SCHINDEWOLF U
12-11318
SCHIRMER H
12-11552
SCHLUTER R A
12-11629
SCHMEISER KURT
12-11572
SCHMID E
12-12020
SCHMID W
12-11248
SCHMIDT R A
12-11822
SCHNEIDER H
12-11632
SCHNURER G T
12-11833

SCHOCK A
12-11822
SCHOPPER E
12-11512 12-11513
SCHOPPER H
12-11492
SCHROEDER M A
12-11285
SCHUCH A F
12-11530
SCHULTZ H L
12-11747
SCHUMACHER E
12-11372
SCHWARTZ C L
12-11978
SCHWARTZ W
12-11857
SCHWENDIMAN L C
12-11222
SCHWIEN I F
12-11369
SCOFIELD JAMES H
12-11796
SEDNEY R
12-11399
SEGE G
12-11944
SEGRE E
12-11996
SEIDENSTICKER R W
12-11941
SEIDLITZ L
12-11990
SEIGLE L
12-11453
SELENGUT D S
12-11922
SELLEN J M
12-11650
SEMASHKO I A
12-12038
SEMENOVA L A
12-11465
SENENT F
12-11604
SERDOBOV M V
12-11964
SERY R S
12-12019
SESSLER A M
12-11803
SFTH K K
12-11687 12-11791
SHADURI R S
12-12004
SHAMOV V P
12-12093
SHAMSHEV V N
12-11753
SHAPIRO F L
12-11727
SHARPE J
12-11616
SHATZKES M
12-11984
SHAW E R
12-11437
SHCHERBAKOVA M N
12-11521
SHEKARCHI ISABEL C
12-11244
SHELBERG W E
12-12041
SHELINE R K
12-11782
SHERMAN F G
12-11290
SHERMAN J
12-11939
SHIMIN R L
12-11370
SHIRLEY E L
12-11310
SHITOV E V
12-11658
SHORE F J
12-11704
SHORTHILL R W
12-12047
SHULER WOODFIN E
12-11360
SIDDALL THOMAS H III
12-11360
SIDHU S S
12-11528
SIDOROV V A
12-11739 12-11740
SIEGEL R
12-11403
SIEMSSEN R H
12-11812
SIEVERTS ADOLF
12-11491
SIGNARBIEUX CL
12-11685
SIGNER P
12-11811
SIKKEMA C P
12-11731
SILAR JOSEF
12-11613
SIMMONS JENNINGS
12-11829
SIMNAD M T
12-11833
SIMON ALBERT
12-11544
SIMONS JOHN C JR
12-12086
SIMPSON J H
12-11756
SINCLAIR D A
12-11512 12-11513
SINGH BRAT PAL
12-11612
SINITSYN V I
12-11553
SISLER F D
12-11223
SKIFF EDSON W
12-11569
SKILES D O
12-11370
SKINNER R E
12-11487
SKLENSKY R
12-11249
SKOK JOHN
12-11269
SLANSKY C M
12-11294
SLATER D
12-11473
SLAUGHTER G G
12-11703
SLEEPER H P
12-11833
SLOMAN M L
12-11866 12-11867
12-11868
SMALL W J
12-11819 12-11917
SMETS H B
12-11930
SMIRNOV L S
12-11558
SMIRNOV L V
12-11671
SMITH CHESTER J
12-11566
SMITH DURWOOD J
12-11246
SMITH F M
12-11986 12-11997
SMITH G G
12-11877 12-12092
SMITH S L
12-11889
SMOCK R M
12-11250
SMOLUCHOWSKI R
12-11529 12-12023
SMORODINSKY YA
12-11761
SNOWDEN S C
12-11729
SNOWDON S C
12-11587
SNYDER T M
12-11786
SOBOLEV G A
12-11331
SOKOLOV A A
12-11561
SOKOLOVSKII V V
12-11690
SOKUROVA E N
12-11241
SONA A
12-11733
SOPPET JEAN F
12-11422
SOROKIN P P
12-11798
SPARROW A H
12-11250
SPEICHER H B
12-11218
SPIRIDONOV V M
12-11966 12-11967
SPIRIDONOV V P
12-11931
SRIVASTAVA PREM PRAKASH
12-11649
STAIRS M E
12-11850
STALDER JACKSON R
12-11400
STANFORD A L JR
12-11626
STANYUKOVICH K P
12-11402
STAUB H H
12-11776
STAUFFER L H
12-11972
STEELE DAVID R
12-11304
STEELE OLIVER P III
12-11414
STEINER H
12-11996
STELZER KLAUS
12-11621
STELZNER R W
12-11342
STEPANOV A M
12-12076
STERN SIDNEY C
12-11304
STEWART JOHN C
12-11837
STIERSTADT KLAUS
12-11494
STOERING J P
12-11721 12-11801
STOKES R H
12-11715
STONE R A
12-11356
STORY J S
12-11951
STRATTON T F
12-11543
STREIFF H J
12-11372
STRELKOV P G
12-11301
STRELLA S
12-11568
STROMINGER D
12-11795
STROTZER GERHARD
12-11547
STRUYK J R
12-11821
SUDARSHAN GEORGE
12-11649
SUGA KOICHI
12-11596
SULLIVAN WILLIAM F
12-11415
SUPP R F
12-11822
SURKOVA L V
12-11519
SUVOROVA G V
12-11239
SVENSSON GUSTAV
12-11515
SVIDERSKAYA Z A
12-11462
SWANN C P
12-11799
SWETS DON E
12-11500
SYRETT J J
12-11949
SZEKELY T
12-11919
SZTEINSZNAIDER D
12-11724

T

TACHON J
12-11885
TAGLIAFERRI G
12-11988
TAIT G W C
12-11261
TAMM E I
12-11658
TAMM I E
12-11661
TANAHASHI GORO
12-11596
TANAKA H
12-11985
TANAKA YASUO
12-11596
TARAYAN V M
12-11313
TARPINIAN M
12-11340
TASCHEK R F
12-11679
TAUTFEST G W
12-11958
TAVKHELIDZE A N
12-12076
TAYLER R J
12-11536
TAYLOR C J
12-11741
TELKOVSKII V G
12-12000
TENDAM D J
12-11990
TENTYUKOVA G N
12-11657
TERLETSKII YA P
12-11976
TERRELL J
12-11710
TESZLER OTTO
12-11351
TEUMIN M I
12-11467
TEUTONICO LOUIS J
12-11404
THELLMANN EDWARD L
12-11454
THENARD M
12-11608
THOMAS BILLY S
12-11654
THOMAS G E
12-11684
THOMAS P
12-11969
THOMAS W R
12-11444
THOMPSON GERALD L
12-11583
THOMPSON J S
12-11285
THOMPSON M W
12-12015
THOMPSON W I
12-11833
THORNDIKE E H
12-11800
THORPE ROY E
12-11349
TICHO H K
12-11986
TIENSUU VICTOR H
12-11982
TILLEY D R
12-12034
TINLOT J
12-11651
TIPTON CLYDE R JR
12-11442
TOLBERT BERT M
12-11282
TOLMACHEV V V
12-12077
TOMCZAK Z
12-11489
TORKI BECHIR
12-11953
TOUSCHEK B
12-12070
TRAMMELL G T
12-12049
TRETYAKOV E F
12-11814
TRETYAKOVA M I
12-11521
TROITSKY K V
12-11974
TROUBETZKOY E
12-11691
TRUKHLIAEV P S
12-11805
TRUMPY G
12-11748
TRURAN W H
12-11920
TRUSWELL A E
12-11382
TULLY J P
12-11819
TULYAKOV G A
12-11466
TUNNICLIFFE P R
12-11705 12-11706
TURKAUF M
12-11574
TURTON T
12-11232
TWISS S B
12-11416
TYLKINA M A
12-11460

U

UBERALL H
12-11556
ULMER D D
12-11228
UNIK J P
12-11795
UPHAM HARVEY C
12-11266

V

VACCHELLI G
12-11884
VALAER PETER J
12-11268
VALLEE R E
12-11337
VAN BARNEVELD H H
12-11731
VAN PATTER D M
12-11775
VAN RENNES A B
12-11935
VAN STEKELENBURG
L H M
12-11618
VAN WINKLE R
12-11823
VANDERHAEGHE G
12-11988
VANDERSCHMIDT G
FREDERICK
12-12086
VARICAK M
12-11969
VAUGHAN W H
12-11529
VAVILOV V S
12-11558
VEDDER JAMES
12-11637
VENDRYES G
12-11537 12-11714
VENTERS LYDIA
12-11301 12-11423
VIGON SANCHEZ M A
12-11603
VILLANI STELIO
12-11210
VILLAR G E
12-11352
VLADIMIRSKII V V
12-11690
VLASOV N A
12-11739 12-11740
VOEVODSKII V V
12-11334
VOLKOV YU M
12-11998
VOLPE J J
12-11877
VORTMAN L J
12-11258
VOSICKI B
12-11969
VRUBLEVSKII A
12-11668
VYSOCHANSKII A S
12-11506

W

WADSWORTH MILTON E
12-11379
WAGNER E B JR
12-11342
WAGNER PAUL
12-11339
WAGNER R
12-11955
WALKER R M
12-12021
WALKER W H
12-11708
WALLENMEYER W A
12-11968
WALSH PATRICK N
12-11293
WANDEL C
12-11693
WAPSTRA A H
12-11329
WARD F R
12-11932
WASILEWSKI A
12-11623
WATSON L C
12-11386
WATSON PETER G
12-11569
WATSON W K R
12-11655
WATT D A
12-11481

WEBB G R
12-11833
WEBER S A
12-11857
WEEKES DONALD F
12-11897
WEGENER H
12-12001
WEIL J W
12-11785
WEIL JOHN W
12-11901
WEIMER U
12-11576
WEINBERG STEVEN
12-11652
WEISBUCH FEIGA
12-11933
WEISS M L
12-11923
WEISSBART JOSEPH
12-11985
WELLER RICHARD I
12-12028
WEPFER W M
12-11412
WEST ALLAN L
12-11220
WESTCOTT C H
12-11708
WESTIN BJORN
12-11914
WESTRUM EDGAR F JR
12-11480
WEYERER HERMANN
12-11525
WHEELER JOHN A
12-11716
WHETSTONE A
12-11627
WHITE DAVID
12-11293
WHITE H
12-11996
WHITE J F
12-11437
WHITEHEAD C
12-11960
WHITEHEAD W D
12-11734
WHITELAW R L
12-11931
WHITMAN C I
12-11387
WIDMANN A
12-11298
WIECZORKOWSKI E A
12-11860 12-11861
WIEDER H H
12-12010
WIEGAND C
12-11996
WIEGAND D A
12-12023
WIESENACK G
12-11880
WIESNER J B
12-11488
WIETZ ALBERT
12-11211
WIGNER E P
12-11688
WIGTON D A
12-11851
WILETS L
12-11692
WILHELMSEN JENS JR
12-11206
WILKINS J ERNEST JR
12-11840
WILKINSON D H
12-11755
WILKINSON M K
12-11504
WILLIAMS F A
12-11479
WILLIAMS FLOYD J
12-11433
WILLIAMS H K
12-11827
WILLIAMS J
12-12103
WILLIAMS R W
12-11517
WILLIAMS ROBERT L
12-11501
WILSON N E
12-11411 12-11859
WILSON T R
12-11937
WINT CECIL T
12-11864
WINTER KLAUS
12-11953
WIQUIST R C
12-11416
WISSLER R W
12-11285
WITTENBROCK N G
12-11926
WOJTOWICZ S
12-11622
WOLFE B
12-11923
WOLLAN E O
12-11504
WOLTEN G M
12-11447
WOOD P M
12-11921
WOODRUFF O J JR
12-11876
WYATT JAMES L
12-11454
WYMAN W L
12-11446

Y

YAGLE RAYMOND A
12-11946
YAMAMURA STANLEY S
12-11307
YANS F M
12-11448
YATSENKO V F
12-11410
YELISEEV G P
12-11559
YPSILANTIS T
12-11996
YVON P
12-11537

Z

ZAHRINGER J
12-11965
ZAIKOVAKII F V
12-11326
ZAITSET G A
12-12079
ZAITSEV A A
12-11540
ZAJIC VLADIMIR
12-11893
ZAKHAROVA M I
12-11465
ZAMCHALOVA E A
12-11521
ZARIPOV M M
12-11809
ZASTAVENKO L G
12-11983
ZAUBERIS D D
12-11528
ZAVADSKII E A
12-11508
ZAVARIKHINA G R
12-11922
ZAVON MITCHELL R
12-11268
ZEGGER J L
12-11819 12-11917
ZELDES HENRY
12-12049
ZHDANOV G B
12-11521 12-11522
ZHDANOV G S
12-11533
ZHUCHIKIN V I
12-11475
ZHUKOVSKY N N
12-12029
ZHURAVLEV N N
12-11533 12-11534
ZICKEL JOHN
12-11910
ZIEGLER WOLFRAM
12-11906
ZIERING S
12-11751
ZIFFERERO M
12-11381
ZILBERG YU G
12-11231
ZIMANYI J
12-11762
ZIMEN K E
12-11299
ZIMMERMAN E L
12-11846
ZIMMERMAN R L
12-11687 12-11697
12-11791
ZIMMERMANN H J
12-11488
ZIPOY D M
12-11802
ZOLOTUKHIN V K
12-11525
ZURIANI A
12-11288
ZUPRANSKI P
12-11622
ZVEREV G M
12-11673

NUMERICAL INDEX OF REPORTS

This is a list of reports abstracted in this issue of *Nuclear Science Abstracts*, with the corresponding abstract number reference.

The report number codes listed below apply to AEC reports unless otherwise designated. Other codes are listed as British, Canadian, or Non-AEC. Those codes marked Misc. are used for both AEC and non-AEC reports. For a complete description of all report number codes used by the AEC, see TID-85, *Report Number Series Used by the Technical Information Service in Cataloging Reports*. September 1957. 112p. $3.00 (OTS). Some reports appear under more than one code designation and wherever practical all report numbers are listed in this index.

Report No.	Abstract No.
AD (Misc.)	
118230	12-11349
136414	12-11977
137088	12-11479
143467	12-12010
150692	12-12043
152220	12-11580
154122	12-11406
154196	12-11293
157163	12-11257
158211	12-11756
158284	12-12044
158287	12-11978
158313	12-11426
ADD	
58-12	12-11577
AEC-tr	
2944	12-11456
3219	12-11313
3226	12-11410
3239	12-11423
3263	12-11671
3265	12-11525
3272	12-11231
3275	12-11600
3280	12-11299
3284	12-11300
3285	12-11301
3286	12-11389
3290	12-11601
3294	12-11491
AECD	
4264	12-12087
4266	12-11384
AECL (Canadian)	
556	12-11358
573	12-11443
586	12-11386
591	12-11444
AECU	
3515	12-11754
3643(Pt. 2)	12-11577
3668	12-11578
3694	12-11815
3701	12-12040
3702	12-12043
3708	12-11404
3729	12-11385
3734	12-11563
3750	12-11355
3751	12-11356
3752	12-11379
3753	12-11480
3756	12-11579
3758	12-11674
AERE-C (British)	
R-847(Del.)	12-11382
R-1212	12-11291
R-2221	12-11291
R-2494	12-11305
AERE-CE (British)	
R-821	12-11481
AERE-ED (British)	
R-1843	12-11481
AERE-EL (British)	
M-70	12-11482
AERE-G (British)	
R-783	12-11564
AERE-GP (British)	
R-2372	12-11564
AERE-Lib/Trans (British)	
768	12-11492
785	12-11232
AERE-M (British)	
R-1409	12-11383
R-2416	12-11383
R-2485	12-11405
AERE-R (British)	
M-161	12-11816
R-2245	12-11891
R-2506	12-11817
AERE-T (British)	
M-93	12-11292
M-158	12-11536
R-114	12-11818
R-2492	12-11755
AF-SAM (Non-AEC)	
57-59	12-11224
58-63	12-11225
58-73	12-11226
AFOSR-TN (Non-AEC)	
57-425	12-11977
58-29	12-11580
58-221	12-11406
58-291	12-11293
58-407	12-11756
58-473	12-12044
58-476	12-11978
AFOSR-TR (Non-AEC)	
58-73	12-11426
AFSWC-TN (Non-AEC)	
57-30	12-11257
AGC-AE (Misc.)	
40	12-11441
ALI-C (Misc.)	
60808	12-11847
AMRL (Non-AEC)	
344	12-11227
345	12-11228
APAE	
23	12-11819
APAE-Memo (Misc.)	
108	12-11820
BMI (Misc.)	
1070(Del.)	12-11442
BNL	
3305	12-11336
3377	12-12028
3494	12-11647
3534	12-11791
3654	12-11250
BRL (Non-AEC)	
962	12-11399
988	12-11483
BRL-Memo (Non-AEC)	
1132	12-11484
CEA (Non-AEC)	
691	12-11205
699	12-11608
702	12-11567
706	12-11424
707	12-11432
708	12-11344
713	12-12048
715	12-11425
728	12-11537
736	12-11395
739	12-11470
CENC	
1001	12-11827
1004	12-11828
1006	12-11829
1011	12-11830
CF (Oak Ridge National Lab.)	
54-8-237	12-11821
56-9-133	12-11357
57-1-26	12-11427
57-3-73	12-11485
57-8-12	12-11822
57-12-8(Rev.)	12-11823
58-1-26	12-11330
58-4-53	12-11824
58-5-78	12-11825
58-6-11	12-11428
58-6-30	12-11581
58-6-42	12-11826
58-6-59	12-11429
58-6-91	12-11347
CRCE (Canadian)	
716	12-11386
743	12-11358
CRMet (Canadian)	
722	12-11831
753	12-11443
766	12-11444
CU (Misc.)	
41-58-AF-677-EE	12-11580
CWR	
444	12-11979
459	12-11980
495	12-11775
DP	
248	12-11445
250	12-11359
258	12-12088
267	12-11594
269	12-11430
283	12-11360
FICO	
101(Vols. 1 and 2)	12-11832
FZK (Non-AEC)	
9-126-2	12-12009
GA	
56(Pt. 1)	12-11833
GAT-DM	
619(Rev. 1)	12-11582
GAT-L	
405	12-11398
HASL	
33	12-11306
HTR/PWP (British)	
P-5	12-11817
HW	
49816	12-11446
53230	12-12018
53504	12-11486
53710	12-12024
55516	12-11407
56185A2	12-11834
56199	12-11595
HZ	
99	12-11454
IDO	
2021(Rev. 1, App.)	12-11835
14436	12-11307
14442	12-11294
16397	12-11837
16442	12-11308
IGO-AM (British)	
W-112	12-11309
INSJ (Non-AEC)	
9	12-11596
ISC	
929	12-11295
968	12-11562
KAPL-M	
JS-3	12-11837
VFC-3	12-11310
WKA-12	12-11838
KS	
267(Del.)	12-12087
399(Del.)	12-11384
KT	
310	12-11355
319	12-11356
KY	
240	12-11296
LA	
2144	12-12089
2207	12-11284
M (Misc.)	
6404	12-11480
MLM	
1076	12-11337
MURA (Misc.)	
407	12-11968
NAA-SR	
2312	12-11447
2551	12-11487
NAA-SR-Memo	
1389	12-11340
NACA-RM (Non-AEC)	
SE57F28	12-11839
NACA-TN (Non-AEC)	
3786	12-11408
4141	12-11400

NUMERICAL INDEX OF REPORTS

Report No.	Abstract No.
NARF (Non-AEC)	
58-1T(Add. 2)	12-12009
NAVORD (Non-AEC)	
4621	12-12010
NDA (Misc.)	
14-128	12-11840
84-7	12-11841
NEVIS (Misc.)	
37	12-11766
61	12-11651
NMI	
1192	12-11448
NOLC (Non-AEC)	
374	12-12010
NP (AEC File No. for Non-AEC Reports)	
6723	12-11348
6732	12-11449
6748	12-11842
6774	12-11394
6775	12-11488
6777	12-11843
6779	12-12059
6780	12-11311
6781	12-11489
6782	12-11636
6786	12-12011
6787	12-11844
NP-tr (AEC File No. for Non-AEC Translations)	
90	12-11638
103	12-11757
104	12-12060
106	12-11371
NPG (Canadian)	
7(AECL)	12-11332
NRDC (British)	
73(Del.)	12-11951
NYO	
6397	12-11380
7788	12-11450
7829	12-11529
8056	12-11675
8504	12-11845
8664	12-11451
ORINS	
20	12-11276
ORNL (Oak Ridge National Lab.)	
2484	12-11846
2494	12-11452
2533	12-11229
2542	12-11538
ORO	
175	12-11230
RFP	
53	12-11312
RL (Misc.)	
4M-58	12-11350
RM (Misc.)	
2118(AEC)	12-12043
RME	
3152	12-11433
3155	12-11434
RMO	
2601	12-11361
2604	12-11362
2605	12-11363
2606	12-11364
2608	12-11365
2609	12-11366
2610	12-11367
2613	12-11368
2615	12-11369
SCL-T	
151	12-11727
SCNC	
241	12-11387
SCR	
11	12-11583
12	12-11409
13	12-11584
SCTM	
58-58-81	12-11565
162-58(14)	12-11566
176-58(51)	12-11490
217-58(51)	12-11258
243-54(51)	12-11669
302-57(51)	12-11670
SEP (Misc.)	
247	12-11453
SO	
6200	12-11847
SRO	
12	12-11454
TEI	
123	12-11435
TID	
7547	12-11676
7547(p. 3-9)	12-11677
7547(p. 9-13)	12-11678
7547(p. 14-18)	12-11679
7547(p. 19-27)	12-11680
7547(p. 27-30)	12-11681
7547(p. 30-5)	12-11682
7547(p. 35-7)	12-11683
7547(p. 37-9)	12-11684
7547(p. 39-42)	12-11685
7547(p. 42-5)	12-11686
7547(p. 45-8)	12-11687
7547(p. 49-50)	12-11688
7547(p. 50-2)	12-11689
7547(p. 52-4)	12-11690
7547(p. 54-7)	12-11691
7547(p. 57-62)	12-11692
7547(p. 62-3)	12-11693
7547(p. 63-8)	12-11694
7547(p. 68-71)	12-11695
7547(p. 71-7)	12-11696
7547(p. 77-9)	12-11697
7547(p. 79-81)	12-11698
7547(p. 81-4)	12-11699
7547(p. 85-91)	12-11700
7547(p. 92-7)	12-11701
7547(p. 98-105)	12-11702
7547(p. 105-6)	12-11703
7547(p. 107-12)	12-11704
7547(p. 112-13)	12-11705
7547(p. 113-16)	12-11706
7547(p. 117-18)	12-11707
7547(p. 118-21)	12-11708
7547(p. 121-5)	12-11709
7547(p. 125-30)	12-11710
7547(p. 130-5)	12-11711
7547(p. 135-8)	12-11712
7547(p. 139-40)	12-11713
TID	
7547(p. 140-2)	12-11714
7547(p. 142-6)	12-11715
7547(p. 146-52)	12-11716
7547(p. 153-9)	12-11717
7547(p. 159-62)	12-11718
7547(p. 162-6)	12-11719
7547(p. 167-70)	12-11720
7547(p. 170-3)	12-11721
7547(p. 173-7)	12-11722
7547(p. 178-81)	12-11723
7547(p. 181-3)	12-11724
7547(p. 184-9)	12-11725
7547(p. 190-1)	12-11726
7547(p. 191-5)	12-11727
7547(p. 195-8)	12-11728
7547(p. 198-202)	12-11729
7547(p. 202-5)	12-11730
7547(p. 205-7)	12-11731
7547(p. 207-9)	12-11732
7547(p. 210-13)	12-11733
7547(p. 213-17)	12-11734
7547(p. 218-25)	12-11735
7547(p. 225-30)	12-11736
7547(p. 230-2)	12-11737
7547(p. 232-5)	12-11738
7547(p. 236-40)	12-11739
7547(p. 240-4)	12-11740
7547(p. 244-6)	12-11741
7547(p. 246-8)	12-11742
7547(p. 248-51)	12-11743
7547(p. 252-61)	12-11744
7547(p. 261-3)	12-11745
7547(p. 263-5)	12-11746
7547(p. 266-73)	12-11747
7547(p. 274-6)	12-11748
7547(p. 277-9)	12-11749
TT (Canadian)	
744	12-11512
746	12-11513
UCLA	
387	12-11243
396	12-11266
UCRL	
3606	12-11236
3619	12-12045
3768	12-11986
3769	12-11987
3789	12-11597
3852	12-11282
4812	12-11593
4908	12-11570
4955	12-11571
4992	12-11219
5022	12-11997
5136	12-12022
8048	12-11283
8183	12-11992
8202	12-11637
8202(Suppl.)	12-11637
8231	12-11996
8274	12-11598
UK/C (British)	
6/119	12-11708
6/124	12-11705
6/125	12-11706
USNRDL-TR (Non-AEC)	
229	12-11509
241	12-12041
USNRDL-TR-(Non-AEC)	
242	12-11599
WADC-TR (Non-AEC)	
53-63(Pt. 5)	12-11349
57-255(Pt. 2)	12-11350
WAPD	
629	12-11939
WAPD-A1W	
(PF)-398	12-11848
WAPD-CTA	
EL-1004	12-11849
(IH)-208	12-11259
WAPD-NCE	
5215	12-11850
WAPD-NCM	
PL-51	12-11851
WAPD-P	
659	12-11852
707	12-11585
WAPD-PC	
234	12-11853
WAPD-PWR	
CP-1912	12-11418
CP-1929	12-11418
CP-1930	12-11418
CP-1945	12-11418
CP-1974	12-11854
CP-2130	12-11855
CP-2427	12-11388
CP-2457	12-11856
CP-2704	12-11297
CP-3025	12-11857
PA-350	12-11858
PC-748	12-11859
PC-983	12-11411
PC-1338	12-11860
PC-1345	12-11861
PCR-172	12-11862
PCR-450	12-11863
PCR-482	12-11864
PCR-849	12-11865
PMA-1492	12-11866
PMA-1504	12-11867
PMA-1536	12-11868
PMF-789	12-11869
PMF-868	12-11870
PMF-1184	12-11871
PMM-1220	12-11455
RD-606	12-11872
RD1-75	12-11873
WAPD-RD	
43	12-11874
WAPD-RDm	
109	12-11874
WAPD-STR	
L-192	12-11875
WAPD-T	
583	12-11876
640	12-12092
680	12-11911
WAPD-TM (Misc.)	
117	12-11586
119	12-11877
WIN	
32	12-11370
YAEC	
31	12-11878
46	12-11879
59	12-11422

DEPOSITORIES OF USAEC REPORTS IN LIBRARIES OUTSIDE THE U.S.

The libraries listed below maintain collections of unclassified U. S. Atomic Energy Commission reports for reference use.

ARGENTINA
Buenos Aires, Comisión Nacional de Energía Atomica

AUSTRALIA
Canberra, Australian National Library
Sutherland, New South Wales, Australian Atomic Energy Commission

AUSTRIA
Vienna, Institut für Radiumforschung der Oesterreichischen Akademie der Wissenschaften
Vienna, International Atomic Energy Agency

BELGIUM
Brussels, Centre d'Etudes pour les Applications de l'Energie Nucléaire

BRAZIL
Rio de Janeiro, Instituto Brasileiro de Bibliografia e Documentacao

BURMA
Rangoon, Union of Burma Applied Research Institute

CANADA
Ottawa, National Research Council Library

CEYLON
Colombo, University of Ceylon

CHILE
Santiago, Ministerio de Relaciones Exteriores

COLOMBIA
Bogotá, Instituto Colombiano de Asuntos Nucleares

COSTA RICA
San Pedro, University of Costa Rica Library

CUBA
Havana, Comisión de Energía Nuclear de Cuba

DENMARK
Risö, Danish Atomic Energy Commission

DOMINICAN REPUBLIC
Ciudad Trujillo, National Palace

EGYPT
Cairo, Atomic Energy Commission

ENGLAND
Birmingham, Central Library
Bristol, Central Library
Kingston upon Hull, Central Library
Leeds, Central Library
Liverpool, Central Library
London, Central Library, Acton
London, Science Museum Library, South Kensington
Manchester, Central Library
Newcastle upon Tyne, Central Library
Nottingham, Public Libraries
Sheffield, Central Library

FINLAND
Helsinki, Teknillisen Korkeakoulun Kirjasto

FORMOSA (TAIWAN)
Taipei, National Tsing Hua University Library

FRANCE
Gif-sur-Yvette, Centre d'Etudes Nucléaires de Saclay
Paris, Organization for European Cooperation, Nuclear Energy Library

GERMANY
Berlin, Institut für Kernforschung Berlin
Munich, Technische Hochschule, Bibliothek

GREECE
Athens, Greek Atomic Energy Commission

GUATEMALA
Guatemala Comisión Nacional de Energía Nuclear

HAITI
Port au Prince, University of Haiti

ICELAND
Reykjavik, University of Iceland, Atomic Energy Library

INDIA
Bombay, Department of Atomic Energy

IRAQ
Baghdad, The Ministry of Development, Atomic Energy Division

IRELAND
Dublin, University College

ISRAEL
Tel Aviv, Israel Atomic Energy Commission

ITALY
Rome, Comitato Nazionale Ricerche Nucleari

JAPAN
Tokyo, Science Section, Diet Library

KOREA
Seoul, Atomic Energy Commission, c/o Ministry of Education

LEBANON
Beirut, American University

LUXEMBOURG
Luxembourg, Ministry of Transport and Electricity

MEXICO
Mexico, D.F., Comisión Nacional de Energía Nuclear

NETHERLANDS
The Hague, Reactor Centrum Nederland

NEW ZEALAND
Wellington, Department of Scientific and Industrial Research

NORTHERN IRELAND
Belfast, Department of Industrial and Forensic Science

NORWAY
Lillestrøm, Institutt for Atomenergi

PAKISTAN
Karachi, Atomic Energy Commission

PERU
Lima, Biblioteca Nacional

PHILIPPINE REPUBLIC
Manila, Interdepartmental Committee on Atomic Energy, c/o National Economic Council

PORTUGAL
Lisbon, Junta de Energía Nuclear

SCOTLAND
Glasgow, Mitchell Library

SPAIN
Madrid, Junta de Energía Nuclear

SWEDEN
Stockholm, Atomenergi AE

SWITZERLAND
Geneva, United Nations Library
Zurich, Institut für Physik, Eidg. Technische Hochschule

THAILAND
Bangkok, Office of the Thai Atomic Energy Commission, Department of Science

TURKEY
Ankara, Turkish Atomic Energy Commission, Atomic Energy Library

UNION OF SOUTH AFRICA
Pretoria, Library and Information Division, South African Council for Scientific and Industrial Research

UNITED NATIONS
New York, N. Y., U.N. Headquarters

URUGUAY
Montevideo, Universidad de Montevideo

VENEZUELA
Caracas, Instituto Venezolano de Neurología e Investigaciones Cerebrales

YUGOSLAVIA
Belgrade, Federal Nuclear Energy Commission

LEGAL NOTICE

The AEC reports listed in this document are accounts of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in these reports, or that the use of any information, apparatus, method, or process disclosed in these reports may not infringe privately owned rights; or

B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in these reports.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission to the extent that such employee or contractor prepares, handles or distributes, or provides access to, any information pursuant to his employment or contract with the Commission.

UNITED STATES
GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS
WASHINGTON 25, D. C.

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE TO AVOID
PAYMENT OF POSTAGE, $300
(GPO)

TECHNICAL PROGRESS REVIEWS

The U. S. Atomic Energy Commission, Technical Information Service, publishes an unclassified series of Technical Progress Reviews which provide concise summaries of current atomic developments. Issued quarterly, each of these Technical Progress Reviews digests and evaluates the latest findings in a specific area of nuclear technology and science. The Reviews also report on technology developed in military reactor and other classified AEC programs to the extent that the technology can be dissociated from sensitive military and production data.

The three journals currently published in this series are:

Power Reactor Technology, Walter H. Zinn and associates, General Nuclear Engineering Corporation

Reactor Fuel Processing, Stephen Lawroski and associates, Chemical Engineering Division, Argonne National Laboratory

Reactor Core Materials (covering solid material developments), R. W. Dayton, E. M. Simons, and associates, Battelle Memorial Institute

Each journal may be purchased by subscription (domestic, $2.00 a year; foreign, $2.50 a year) or by individual issue (55¢) from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.